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CUSTOMER SERVICE ANALYSIS OF  
AIR COMBAT COMMAND VEHICLE  
MAINTENANCE SUPPORT

THESIS

Lori M. Bass, Captain, USAF  
Linda J. Dahl, Captain, USAF

AFIT/GLM/LAC/93S-5

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CUSTOMER SERVICE ANALYSIS OF  
AIR COMBAT COMMAND  
VEHICLE MAINTENANCE SUPPORT

THESIS

Presented to the Faculty of the  
School of Logistics and Acquisition Management  
of the Air Force Institute of Technology  
Air University  
In Partial Fulfillment of the  
Requirements for the Degree of  
Master of Science in Logistics Management

Lori M. Bass, B.S.  
Captain, USAF

Linda J. Dahl, B.S., M.P.A.  
Captain, USAF

September 1993

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### Acknowledgements

We would like to thank Dr. Larry W. Emmelhainz and Dr. Craig M. Brandt, our thesis advisors, for their guidance and direction throughout the entire thesis project. Their combined expertise and knowledge provided us with an unlimited resource of ideas and suggestions. Without their constant help, this project would not have been possible. We would also like to thank Dr. Guy Shane for assisting in the statistical analysis of the data. For his willingness to share his vast knowledge of SAS®, the researchers are eternally grateful.

We would also like to express our appreciation to Jonna Hamrick from the AFIT/LAA Graduate Programs office. She was always there when we needed her. Her technical advice as well as her endless 'errand running' made it possible to reproduce and distribute our surveys on time.

A very special thank you goes to Col Ronald W. Waggoner, ACC/LGT, for sponsoring this research and giving us his full support during the project. We would also like to thank the entire ACC Transportation Staff for their help and encouragement during this project.

Finally, a sincere thank you to all the ACC Transportation Squadron Commanders, our base POCs, and the transportation customers who participated in our project. Without your help, we could not have completed this work.

Captain Lori M. Bass

Captain Linda J. Dahl

## Table of Contents

	Page
Acknowledgements . . . . .	ii
List of Figures . . . . .	v
List of Tables . . . . .	vi
Abstract . . . . .	viii
 I. Introduction . . . . .	 1
General Issue . . . . .	1
Problem Background . . . . .	4
Research Problem . . . . .	5
Research Objective . . . . .	5
Specific Objectives . . . . .	5
Scope and Limitations . . . . .	6
Investigative Questions . . . . .	7
Summary . . . . .	8
 II. Literature Review . . . . .	 9
Introduction . . . . .	9
Customer Service Defined . . . . .	9
Research In Customer Service . . . . .	12
LaLonde and Zinszer, 1976 . . . . .	13
Sterling and Lambert, 1987 . . . . .	17
LaLonde, Cooper and Noordewier, 1987 . . . . .	18
Lambert and Harrington, 1989 . . . . .	20
The Importance of Customer Service . . . . .	21
Customer Service in the Military . . . . .	23
Customer Service Criteria . . . . .	24
Customer Service Measurements . . . . .	31
Service Measures in Civilian Organizations . . . . .	31
Service Measures in Federal Organizations . . . . .	36
Summary . . . . .	38
 III. Methodology . . . . .	 40
Literature Review . . . . .	41
Population and Sample Identification . . . . .	41
External Audit . . . . .	43
Survey Design . . . . .	43
Pretest . . . . .	46
Survey Distribution and Data Collection . . . . .	47
Data Analysis . . . . .	48
Summary . . . . .	51

	Page
IV. Results and Analysis . . . . .	53
Survey Response Rate . . . . .	53
Reliability Analysis . . . . .	54
Sample Distribution and Assumptions . . . . .	55
Analysis Overview . . . . .	56
Customer Service Elements--Importance and Performance . . . . .	56
Investigative Question 1 . . . . .	56
Investigative Question 2 . . . . .	59
Investigative Question 3 . . . . .	64
Differences Between Customer Groups . . . . .	65
Investigative Question 4 . . . . .	66
Investigative Question 5 . . . . .	66
Synopsis . . . . .	98
Additional Comments . . . . .	99
Conclusion . . . . .	100
V. Conclusions and Recommendations . . . . .	101
Specific Objective 1 . . . . .	101
Specific Objective 2 . . . . .	104
Specific Objective 3 . . . . .	107
By Prior Command . . . . .	107
By Organization . . . . .	108
By Fleet Size . . . . .	111
By Military Rank . . . . .	113
By Type/Class Vehicle . . . . .	115
Synopsis . . . . .	118
Specific Objective 4 . . . . .	119
General Recommendations . . . . .	124
Appendix A: Customer Satisfaction Survey . . . . .	128
Appendix B: Frequency Distributions of Respondent Groups . . . . .	144
Appendix C: Importance and Performance Rankings for Customer Service Criteria . . . . .	146
Bibliography . . . . .	149
Vita . . . . .	154
Vita . . . . .	155

## List of Figures

Figure	Page
1. Criteria for Product Sourcing Decisions. . . . .	26
2. Research Design Tests. . . . .	52

## List of Tables

Table	Page
1. Comparison of Rankings of Important Service Criteria . . . . .	29
2. Effectiveness Determinants and Dimensions for Physical Distribution Services. . . . .	34
3. Customer Service Measures Used by Leading Edge Logistics Firms . . . . .	35
4. Reliability Coefficients for Composite Variables. . . . .	55
5. Importance Rankings for Customer Service Attributes for the Entire Sample . . . . .	57
6. Importance Rankings for Customer Service Criteria for the Entire Sample . . . . .	58
7. Importance and Performance Rankings for Attributes for the Entire Sample. . . . .	59
8. Importance and Performance Rankings for Criteria for the Entire Sample. . . . .	62
9. Differences in Attribute Rankings by Prior MAJCOM at a .05 Level of Significance. . . . .	69
10. Differences in Criteria Rankings for Performance by MAJCOM at a .05 Level of Significance . . . . .	71
11. Differences in Attribute Rankings by Organization at a .05 Level of Significance . . . . .	73
12. Differences in Criteria Rankings by Organization at a .05 Level of Significance . . . . .	75
13. Differences in Attribute Ratings by Organization at a .05 Level of Significance . . . . .	78
14. Differences in Attribute Rankings by Fleet Size at a .05 Level of Significance . . . . .	81
15. Differences in Criteria Rankings by Fleet Size at a .05 Level of Significance . . . . .	83
16. Differences in Attribute Rankings by Rank at a .05 Level of Significance . . . . .	84

	Page
17. Differences in Criteria Rankings by Rank at a .05 Level of Significance . . . . .	87
18. Differences in Attribute Ratings by Rank at a .05 Level of Significance . . . . .	90
19. Differences in Criteria Rankings by Type/Class Vehicle at a .05 Level of Significance . . . . .	93
20. Differences in Attribute Ratings by Type/Class Vehicle at a .05 Level of Significance . . . . .	96
21. Importance Rankings for Customer Service Criteria . . . . .	102
22. Importance and Performance Rankings for Customer Service Attributes . . . . .	104
23. Importance and Performance Rankings for Customer Service Criteria . . . . .	106

Abstract

The purpose of this study was to recommend a set of Vehicle Maintenance performance measures that provide a comprehensive assessment of service quality. A survey was used to collect customer service inputs from Vehicle Maintenance customers from various organizations throughout ACC.

The research had four specific objectives: 1) identify the customer service elements important to Vehicle Maintenance customers; 2) identify customer perceptions about how Vehicle Maintenance meets those elements; 3) compare the perceptions of different customer groups; and 4) recommend a set of customer oriented Vehicle Maintenance performance measures.

Data analysis revealed that quality and timeliness were the service factors most important to Vehicle Maintenance customers. Analysis also indicated distinct differences between what customers want, and what they actually receive. Furthermore, the study revealed apparent differences in the service needs of various customer organizations.

Based the their findings, the researchers concluded that the most comprehensive Vehicle Maintenance performance measurement system should incorporate both quality and timeliness measures. Additionally, it is more appropriate

for such a system to take an organizational, rather than a base-wide, focus. Recommendations were offered to Vehicle Maintenance managers and suggestions for future research were given.

CUSTOMER SERVICE ANALYSIS OF AIR COMBAT COMMAND  
VEHICLE MAINTENANCE SUPPORT

I. Introduction

General Issue

The emphasis on quality service has steadily increased in private and public industry over the past 10 years. Experts cite two reasons for this emphasis: a growing awareness of the importance of personal service and increasing competition for market share (2:50). Private industry's commitment to quality is redefining corporate philosophies and encouraging executives to expand their focus to include quality and value-added processes as a way to achieve increased profits. From this quest for excellence, two related and equally important issues have emerged--service quality and evaluating the service encounter (8:92).

A 1990 study conducted for the Council of Logistics Management (CLM) noted that this new service oriented philosophy is considerably different from the profit driven ideology of 20 years ago. Until recently, success in business was based primarily on product delivery. No significant emphasis was placed on the quality of the product, the service provided to the customer, or whether the product served the customer's needs. But the rules have

changed; providing acceptable service is no longer good enough. Companies are focusing on customization, responsiveness, and flexibility to better meet the needs of customers. Eighty-five percent of the respondents in the CLM study agreed that service goals should be based on customer requirements (16:63). Therefore, to succeed, a proactive approach to identifying customer requirements is needed by the service organization (9:73-79).

Companies today must do more than produce a great product; they must continue to improve and refine service. Today when customers buy a product, they are looking for more than just the physical commodity; they want suppliers who provide a quality product and quality service. The 1990 CLM study also examined how customers differentiated between suppliers in their purchasing decisions. Product quality and service were identified as top customer concerns (9:65). Exploratory research consistently points to customer satisfaction and customer service as key ingredients to successful quality programs. Leading edge firms work diligently to satisfy customers by developing a strategy for quality service. Most importantly, these firms have a clear understanding of what services create value for their customers and develop day-to-day procedures to consistently meet their customers' needs (6:14-21). For many businesses the product may no longer be the competitive commodity. Product quality is a must and, in many cases, service has become the differentiating factor. "It's hard to imagine

any service company faring well in the decade ahead if its service is suspect" (39:38).

With continuing pressure to reduce the budget deficit and cut spending, the Department of Defense (DOD) is looking for ways to improve its processes. To reach this objective the DOD is trying to incorporate quality initiatives into the defense process (16:1-5). While the military does not compete for market shares or profits, quality and customer service are emerging as important cornerstones in future organizational strategy. The DOD Total Quality Management (TQM) training guide stresses the importance of identifying the customer and meeting their requirements.

The customer defines the purpose of the organization and every process within it. Success means striving to become the best supplier of your particular products and services in the minds of your customers...This approach to customer service applies to each organizational process...Because the organization and its processes exist to serve the customer, your improvements are of no benefit unless they are directly passed to the customer in terms of higher quality products and services. (16:2-12)

The TQM guide identifies the following six steps as a way to focus on the customer: 1) link organizational purpose to customer satisfaction; 2) identify your customer; 3) ensure your processes meet customer needs, expectations, and requirements; 4) establish routine and meaningful dialogue with customers; 5) listen to the customer, and 6) involve the customer in planning and decision making (16: 2-12). This guidance clearly parallels the initiatives of the commercial industries.

### Problem Background

In the Air Force, Vehicle Maintenance is a service organization that potentially impacts every other organization on base. Responsible for maintaining an entire base vehicle fleet, which can range from 300 to 900 vehicles, Vehicle Maintenance frequently has a direct impact on critical mission readiness. Maintenance of flightline support, hospital, aircraft refueling, and fire fighting vehicles are four examples. Vehicle Maintenance organizations perform semi-annually scheduled maintenance on each vehicle and unscheduled maintenance for unforeseen requirements. These repairs range from an oil change on a standard sedan to a complete engine overhaul on a 10-ton tractor.

The standard and primary method for measuring performance in an Air Force Vehicle Maintenance organization is through analysis of data compiled in the On-Line Vehicle Integrated Management System (OLVIMS). HQ USAF/LETN (Motor Vehicle Division) has established "indicators to provide a basis for measuring the performance of each level of motor vehicle management" (14:30). OLVIMS provides local maintenance managers with statistics on indicators, to include data on vehicle-out-of-commission rates (VOC), vehicles down for parts, vehicles down for maintenance, labor hours, and a variety of other quantitative measures. These statistics are compared to Air Force standards as well as supplemental standards established by a unit's major

command (MAJCOM) or the local area commander. OLVIMS performance measures are useful in analyzing internal processes like vehicle turn-around time or labor hour usage; however, they give little indication of the customers' satisfaction with Vehicle Maintenance service.

### Research Problem

In Vehicle Maintenance, as in any service organization, the customer is the expert about what he or she wants, and knowing the customer's expectations is management's first step in being able to provide those services. However, in Vehicle Maintenance, performance measures are still management driven, not customer driven; no standard customer oriented measures exist for Vehicle Maintenance managers.

### Research Objective

The objective of this research is to recommend a more comprehensive set of Vehicle Maintenance performance measures that integrate the ideas of product quality and customer service to provide an overall measure of service quality.

### Specific Objectives

The specific objectives of this research are to

- 1) identify the customer service elements important to base transportation Vehicle Maintenance customers, 2) identify customer perceptions about how Vehicle Maintenance organizations meet those elements, 3) compare the customer

service perceptions of different customer groups (by prior MAJCOM affiliation, organization of assignment, vehicle fleet size, rank, and type/class vehicle operated), and 4) recommend a set of customer oriented Vehicle Maintenance performance measures based on the findings in objectives 1 through 4.

#### Scope and Limitations

Because of time limitations, this research will be limited to surveying the major customers of ACC Vehicle Maintenance organizations. These customers are identified as Civil Engineering, Security Police, Supply, Transportation Vehicle Operations, and aircraft maintenance units from both the Logistics and Operations groups.

ACC bases were chosen primarily for two reasons. First, there are no contract Vehicle Maintenance units in the command. The customer service level provided by contract maintenance units is, in part, dictated by the nature of the contract. The inclusion of such units in this study might bias the research results, and the performance of contract units is a topic beyond the scope of this research. Second, ACC consists of former Tactical Air Command (TAC) and Strategic Air Command (SAC) bases, providing a good mix of units with a variety of missions requiring various levels of Vehicle Maintenance support. No base scheduled for closure before 31 December 1993 was surveyed.

### Investigative Questions

To meet the objectives of this research, the following investigative questions will be answered:

1. What customer service elements are most important to ACC Vehicle Maintenance customers?

2. How do customers perceive the performance of ACC Vehicle Maintenance organizations with respect to those elements identified as important?

3. Are ACC Vehicle Maintenance organizations meeting customers' expectations?

4. Are there differences in what Vehicle Maintenance customers identify as important customer service elements based on the

- a. base's previous major command assignment (SAC/TAC)
- b. respondent's organization of assignment
- c. vehicle fleet size of the respondent's organization
- d. respondent's rank
- e. primary type/class of vehicle operated

5. Are there differences in customers' perceptions of Vehicle Maintenance performance based on the

- a. base's previous major command assignment (SAC/TAC)
- b. respondent's organization of assignment
- c. vehicle fleet size of the respondent's organization
- d. respondent's rank
- e. primary type/class of vehicle operated

## Summary

It has been established that service is the new standard by which customers are measuring an organization's performance. Extensive research has shown that excellence in customer service is not a competitive edge, it is the competitive edge (15:2). These same customer service practices are applicable in the Air Force Vehicle Maintenance environment. The impact Vehicle Maintenance support has on the Air Force mission supports the need to develop specific strategies for customer satisfaction.

This thesis is organized in five chapters. In this chapter, a general introduction to the research topic was provided. Chapter II will provide a review of current literature in the customer service area and the research studies that provided the foundation for this thesis. In Chapter III, the methodology designed and used for this study is described. A description of the data collected and its analysis will be discussed in Chapter IV. Finally, Chapter V will contain the conclusions and recommendations of this research.

## II. Literature Review

### Introduction

The objectives of this literature review were to explore the current literature on customer service and synthesize the important concepts in order to build a foundation for conducting this research. The review focused specifically on those areas most closely related to the issues addressed in this thesis. Those subjects are 1) the definitions of customer service, 2) previous research in customer service, 3) establishing the importance of customer service, 4) the service criteria most important to customers, and 5) customer service measurements.

### Customer Service Defined

Before examining definitions of customer service, it is necessary to comment briefly on who the customer is. Experts recognize two types of customers--those who are internal to an organization, and those who are outside of it. Internal customers are the recipients of products or services within an organization who play a part in creating the overall service experience. External customers are the end users of a product or service; they are the reason a service process exists (43:20). The Air Force's definition of a customer is externally oriented, and the external customers of base transportation are the focus of this research.

With that focus, the researchers compiled definitions of customer service from several organizations and experts on the subject. Considering those definitions, the researchers then developed an operational definition of customer service suitable for this study. This section summarizes the findings of their review of customer service definitions.

Customer service is a common phrase, but the variety of definitions applied to it suggests it does not share a common meaning for every organization. Gilmour listed a number of definitions researched by Heskett that ranged from a quantitative, functional focus (i.e. "the percentage of items in a supplier's warehouse which might be found to be out of stock at any given point in time" (24:84)) to a qualitative, people-oriented focus (i.e. "the ease and flexibility with which the customer can place his order" (24:84)).

Despite the range of definitions for customer service, experts agreed that they fall into specific categories. Both the teams of Stock and Lambert and LaLonde and Cooper refined Gilmour's range of definitions by classifying them as performance related and activity or process related (29:4-5; 47:114). In addition, LaLonde and Cooper referred to a third category of definitions as those outlining specific organizational responsibilities (i.e. "Department X is responsible for...") (29:4). Stock and Lambert also referred to another category in which definitions reflect a

basic corporate philosophy (47:114). Performance and activity related definitions generally have a narrow focus and lend themselves to relatively easy measurement. Organizational and philosophy related definitions are broader in scope and tend to be more customer oriented and less tangible. No single type of definition is universally applicable. The focus an organization chooses depends on the service or product that organization provides, and who they provide it for.

The Council of Logistics Management defined customer service as "a process for providing significant value-added benefits to the supply chain in a cost effective way..."(1:73). Focusing on customer service as a product rather than a process, Stock and Lambert considered customer service an output of the logistics function and "a measure of the effectiveness of the logistics system in creating time and place utility for a product..." (47:122). Taking a more customer oriented approach, The International Customer Service Association focused its definition on business activities that have customer satisfaction as their emphasis and that provide satisfaction by fulfilling sales order demand or information needs (1:73). Surprisingly, despite the military's increasingly customer oriented focus, the literature review revealed no military definitions of customer service per se. However, the researchers did find that it is the DOD's philosophy that the customer defines the purpose of the organization and the quality of its

products and services, therefore implying that customer service is a performance level defined by the customer (16:2-12).

The definitions presented in this section by no means encompassed the entire body of possible customer service definitions, but rather were intended to provide the reader with an idea of the varying perspectives from which leading service organizations and experts approach customer service. As a whole, the review of the literature on customer service definitions revealed two important, underlying themes. The researchers concluded that the more comprehensive definitions 1) considered customer needs, wants and expectations as the focus for the provided service and 2) lent themselves to some form of measurement. Considering these two ideas, the definition of customer service the researchers developed for the purpose of this study is "fulfilling or exceeding customers' requirements and expectations of Vehicle Maintenance". The researchers consider this to be a good operational definition of customer service for Vehicle Maintenance because it incorporates both the ideas of defining service from the customer's perspective and evaluating that service quantitatively.

#### Research In Customer Service

This section has two objectives: 1) to establish the importance of customer service through a review of studies

conducted by recognized leaders in the field of customer service and 2) to simultaneously examine accepted research methodologies. Specifically, studies by LaLonde and Zinszer, Sterling and Lambert, LaLonde and others, and Lambert and Harrington are examined in detail.

LaLonde and Zinszer, 1976. LaLonde and Zinszer's study was conducted across industries and was exploratory in nature. Since the concept of customer service still lacked clear definition, one of their main objectives was to determine how customer service was defined by the industries involved in the study (27:8). LaLonde and Zinszer's methodology had four phases:

a. Concept Definition. First, a literature review was conducted on previous research and writings in the area of customer service to establish the basic parameters for the study. Second, a pretest of the questionnaire and field discussions were conducted to evaluate the proposed questionnaires and the general research design (27:9).

b. Data Collection. Data about the perceptions of the firms' customer service were collected through a series of mail questionnaires. The data were gathered from four sources: the individuals responsible for product distribution, individuals in other functional areas within the corporation, suppliers, and customers. Personal interviews were conducted to supplement survey information (27:10-12).

c. Data Analysis. Data from the four industries were collected, edited, coded, and summarized in three categories: 1) distribution systems, 2) costs of distribution, and 3) customer service elements (27:13).

d. Data Presentation. After analysis, the survey findings were organized by questionnaire stage and by type of industry. Information from personal interviews was integrated into the general model of customer service (27:14-15).

LaLonde and Zinszer found that not all firms explicitly recognized a customer service activity or function. Additionally, they found a wide variety of customer service interpretations. A large number of respondents described customer service as an activity such as order processing, handling of complaints, or troubleshooting. Some regarded customer service and performance levels as synonymous (27:2). The following summarizes LaLonde and Zinszer's findings:

- a. customers were situational in evaluating customer service, concentrating on the atypical poor service rather than the routine, adequate service
- b. most firms did not understand what their customers really wanted in customer service
- c. there was a substantial difference between how industries viewed the various elements of customer service
- d. product availability was considered the most important element of customer service by all of the industries

- e. customer service should first be a management philosophy, preceding the establishment of a set of specific activities
- f. most firms did not measure the costs associated with changes in customer service levels (27:120-169).

Based on their research findings, LaLonde and Zinszer proposed a general model for developing and evaluating a customer service program. The model consists of the following steps:

a. The Customer Service Audit. The first part of the audit identifies those factors used by customers to evaluate their suppliers. The second part focuses on competitive service levels. The third part evaluates the management information system support requirements. In this portion of the audit, the current levels of customer service within the firm are determined and any reports dealing with customer service performance and their recipients are identified (27:179).

b. Establish Customer Service Standards. The standards established should reflect the customers' point of view, provide an operational and objective measure of service performance, and provide management cues for corrective action. In cases where the service standards are established as goals or targets, they must be flexible enough to change with shifting conditions (27:180).

c. Test Cost Sensitivity of Standards. The objective is to determine the cost implications of different levels of performance. LaLonde and Zinszer conceptualized that the

higher the service level, the higher the cost of providing and maintaining those service levels (27:186).

d. Implement Customer Service Standards. This step involves developing an explicit and operational customer service policy statement and thoroughly educating the individuals involved with customer service (27:192).

According to LaLonde and Zinszer,

Without a specific [customer service] written statement, other functional elements...are free to interpret standards as they see fit. This may result in conflicting or contradictory standards and uncertainty in the organization as to the service goals of the firm. (27:191)

e. Develop a Reporting System. The firm must determine what information is needed, who needs it, how often it is needed, and where the information can be obtained. The objective is to provide timely information to those accountable for the customer service strategy of the firm (27:193).

f. Performance Evaluation. Managers must compare actual service performance to target performance levels and take appropriate corrective action when and where needed (27:194).

g. Periodic Review of Standards and Programs. The customer service standards should be reviewed periodically and adjusted to accommodate changes in customer needs, the environment, the firm, and the information needs of management (27:194).

Sterling and Lambert, 1987. Sterling and Lambert studied customer service in the office systems and furniture industry to determine the variables customers used to select or evaluate suppliers and to identify appropriate customer service and integrative marketing strategies (46:2). They used a sequential methodology that they believed was easily adaptable to other industries. The methodology consisted of four phases:

a. External Audit. The external audit consisted of two phases. In the first phase, services important to customers were identified through personal interviews with intermediary and end users that purchased office systems or furniture from all the major industry competitors. Information gathered during the interview process was compiled and used to develop questions for the survey tool (46:8). Prior to developing the survey, the researchers categorized the services or variables into marketing mix components: product, price, promotion, and customer service/physical distribution (46:8). In phase two, the data necessary for the research were collected using the survey developed in phase one.

b. Internal Audit. Suppliers' internal records and reports were audited to determine 1) existing service levels, 2) if and how service was measured and reported to management, and 3) the impact that changes in services would have on the overall market share (46:9).

c. Evaluation of Customer Perceptions. By analyzing the data collected during phase two of the external audit, the researchers identified services customers used to select or differentiate between vendors and recommended actions to improve customer perceptions of services provided (46:9).

d. Identification of Opportunities. This phase consisted of comparing and analyzing the variables identified in the previous three phases to determine a strategic marketing mix (46:9).

After analyzing the data, the researchers rank ordered the variables identified as most important by the respondents. Of the 16 variables identified, 10 were related to customer service/physical distribution. Additionally, they found that customer service/physical distribution was an integral component of the marketing mix, and that it offered significant opportunity for firms to gain an advantage in the market place (46:20-28).

LaLonde, Cooper and Noordewier, 1987. The general purpose of this study was to re-examine the field of customer service and the changes that had taken place since the benchmark study by LaLonde and Zinszer in 1976. The study focused on eight industry groupings and examined the following areas:

- a. the primary themes during the past 10 years in customer service literature
- b. the primary factors that affected the customer service area in the past 10 years, and how they affected it

- c. the change in the focus of customer service in the past 10 years
- d. ways to integrate customer service into the firm's strategic plan
- e. the future role of customer service (29:2).

This study took a three phased approach to research. Phase I involved a comprehensive review of customer service literature from 1976 to 1986. The literature review was analyzed and served as a foundation for Phase II. The second phase included the design and distribution of a mail questionnaire to be answered by various service providers. In Phase III, five case studies were conducted to illustrate "best practice" areas of customer service (29:3).

The researchers identified several significant trends, the most significant being that "customer service had moved from a descriptive/reactive activity of the 1970's to a proactive management activity of the 1980's" (29:5). They found a notable difference in how respondents defined customer service in 1976 and how they defined it in 1987. Respondents in 1976 defined customer service as a narrow function or performance standard whereas in 1987 it was defined as a process. The researchers also identified a shift in customer service performance expectations from a specific point or goal to a window of acceptable performance. Lastly, customer service was becoming an important way of differentiating products or services for many companies and was expected to continue to be a visible force in the future (29:5).

Lambert and Harrington, 1989. Lambert and Harrington replicated the Sterling and Lambert methodology to research customer service in the plastics industry. Their primary purpose was to determine if the Sterling and Lambert methodology could be generalized to other industries (32:53). Their methodology consisted of the following elements:

a. External Audit. The external audit consisted of in-depth personal interviews with 30 customers to gather data for the development of a comprehensive questionnaire. The questionnaire was divided into five parts: part A contained variables used to select and evaluate suppliers; part B collected information about the performance criteria important to customers; part C measured customers' perceptions of service; part D collected information on attitudes/opinions about specific services; and part E collected demographic information.

b. Internal Audit. For the internal audit, interviews were conducted with managers from service organizations to determine 1) their opinions on which customer service considerations were most important, 2) if and how service to the customer was measured, and 3) any existing performance standards.

c. Evaluation of Customers Perceptions. A mail survey was conducted and the results evaluated to determine customers' perceptions of the service provided.

d. Identification of Opportunities. The objective of this phase was to identify areas/services which offered the best opportunity for improved market share and/or profit (32:46).

As a result of their study, Lambert and Harrington concluded that by focusing on what was important to the customer, rather than focusing on the competition, a firm could gain an advantage in the market place. Because their findings paralleled those of Sterling and Lambert, Lambert and Harrington concluded that the earlier study's findings could be generalized to other industries (32:46). Additionally, the common findings between the two studies confirmed to the researchers that customer service variables are integral and necessary to industry and should be a part of corporate strategy (32:42-58).

This section reviewed a number of studies conducted in the area of customer service by some of the recognized leaders in the field. Their combined research documents the changes in the perceptions and importance of customer service in the last 25 years and clearly demonstrates the significance of customer service in industry today.

#### The Importance of Customer Service

In most industries, service is taking on new importance. As early as the late 1970's, companies began to realize that customer service was not just a function or activity, but rather a corporate philosophy (27:205).

Bowersox and others' research of 117 firms designated as logistics leaders identified certain shared corporate attributes regarding customer service. Significantly, all were sensitive to the customers' needs and had a clear understanding of what added value for their customers (6:ii,20). To be successful, companies must do more to serve and satisfy their customers. Specifically, customers want quality products and quality service. Customers want consistent, responsive, flexible service that is based on their requirements (9:65).

Customers want proactive service. In the past, firms often based their customer service levels on industry standards, management judgement, or past practices--not on what customers wanted (16:127). Today, the successful firms will be those that are focused on customers' needs. To meet this objective a firm must satisfy customers' wants or needs, solve customers' problems, and give customers extra value (49:71). To do this, suppliers must identify customer service requirements by interacting with customers and developing services to meet those requirements (9:70). This process is a cycle of continuous improvement involving defining customers' requirements, identifying opportunities for improvement, evaluating service, and then re-examining customers' requirements (9:71). "In the long term, service leaders destroy service followers. The only course for managers interested in survival is to forge and master the ultimate weapon [customer service]" (12:217).

Customer Service in the Military. The customer service studies discussed establish the importance of customer service in commercial industry. However, customer service is no less important in military organizations. While the military does not compete for market shares or profits, the idea of customer service still applies in military organizations as they interact with other units in support of mission readiness. In 1988, when Secretary of Defense Frank Carlucci issued the Department of Defense Posture on Quality letter, the military embarked on its road to quality. This letter gave top priority to the implementation of Total Quality Management (TQM) in the DOD and the attainment of continuous improvement in operations (10:2). An important part of TQM "is identifying the customer and meeting their needs" (16:2-12). The DOD Total Quality Management pamphlet highlights the need for a thorough understanding of the needs of all users [customers]. Going a step further, the pamphlet says this understanding not only provides the means for assessing performance; it also helps the DOD to focus its future direction and establish its future goals (17:4). In these aspects, DOD guidance parallels the customer service initiatives of commercial industry.

The Air Force's quality programs, coined Quality Air Force, focus on process improvement, believing that such improvement will result in a final product that will be cheaper and quicker, and better meet the needs of the

customer. Dr. Donald B. Rice, Secretary of the Air Force, recognizes that with force restructuring, the changing international environment, and declining budgets, the Air Force will have to do business smarter and better in the future (26:7). The objectives of Quality Air Force are to create an environment of continuous, incremental improvement through personnel empowerment and accountability, and through focusing on the process. All these objectives reflect a customer focus (26:9). Anne Foreman, Under-Secretary of the Air Force, stated that

Most critical and unique to quality is a customer focus to everything we do...By customer in total quality, we mean all of those people and components who rely on the product of our work. Identifying one's customers, determining what one's customers really want, and consistently meeting those needs and expectations is the challenge. (26:9)

The same principles promoted in Quality Air Force have been proven in industry and as in industry, a customer focus is essential to the success of Quality Air Force. While the evidence is not extensive, it is clear that senior leaders in the DOD expect the Air Force to identify customer requirements and meet customer needs.

#### Customer Service Criteria

Identifying the customer service criteria most important to customers is key to providing the type of service that continues to draw customers. A number of studies conducted in the commercial sector have identified

important customer service variables using the customers' inputs. This section reviews some of those findings.

Parasuraman, Zeithaml and Berry listed and defined five principle areas by which customers judge a service company:

- a. Tangibles. The appearance of physical facilities, equipment, personnel, and communication materials.
- b. Reliability. The ability to perform the promised service dependably and accurately.
- c. Responsiveness. The willingness to help customers and to provide prompt service.
- d. Assurance. The knowledge and courtesy of employees and their ability to convey trust and confidence.
- e. Empathy. The provision of caring, individualized attention to customers (39:29).

Though somewhat vague, these criteria can easily be refined for measurement and they generally encompass the range of ideas covered in the literature reviewed. Byrne, in a study for the Council of Logistics Management, expanded tangible factors to include "product characteristics and quality, ease of order placement, order accuracy and completeness, timeliness of delivery...and support in areas such as product design, training, maintenance and repair" (8:66). Byrne asked customers across a variety of industries to identify their criteria for making product sourcing decisions and compiled the results shown in Figure 1. Byrne's study indicated that basic product and service quality, including stability of supply, were of primary concern to respondents. These findings support the commonly accepted idea that other sourcing decision variables become

factors "only after suppliers demonstrate they can meet product and service quality requirements" (8:65).

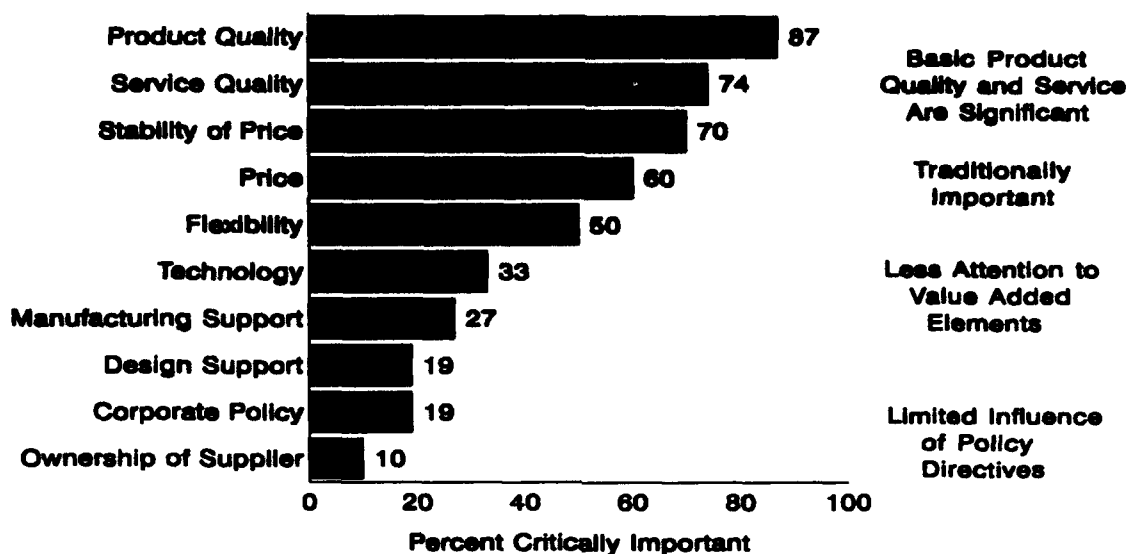


Figure 1. Criteria for Product Sourcing Decisions (9:66)

Additional studies of specific service industries (i.e. transportation, furniture and plastics) revealed that many of the tangible and intangible factors reflected in Byrne's study were rated as important to customers of service organizations in general. However, the exact focus of the most important elements may vary depending on the nature of the industry (32:50; 28:B1-B27). For example, a LaLonde and Cooper study asked shippers in a variety of industries to evaluate the importance of certain customer service elements in selecting a public/contract warehouse. Their study revealed that reliability of the supplier's productivity measurement system was the most important selection criteria among customers (13:B4).

Reviewing management's perspective of the service criteria most important to customers provides additional insight to those factors contributing to the success or failure of service organizations. Successful organizations know what their customers want and are able to deliver it. A Michigan State University study of leading edge logistics firms revealed that high-performance organizations shared several common attributes. Among them were an emphasis on flexibility, "particularly in regard to accommodating special or non-routine requests", a focus on how well the company managed itself and its service to clients, use of a wider range of customer service performance measures, and an overriding commitment to customers (6:IV-V).

A further reflection of the service factors emphasized by successful management was found in the scoring criteria for the Malcolm Baldrige National Quality Award and the Secretary of the Air Force Quality Award. Established in 1987 to help promote quality and productivity in American companies, the Baldrige Award evaluates competitors in the areas of leadership, information and analysis, strategic quality planning, human resource development and management, management of process quality, quality and operational results, and customer focus and satisfaction. Patterned after the Baldrige Award, the Air Force Quality Award was established to help raise quality performance standards and expectations and to promote the improvement of overall organizational performance. The Air Force Quality Award

evaluates competitors according to the same general criteria outlined by the Baldrige Award (23:83; 13:1-8). Of these seven categories, customer focus and satisfaction carries the greatest percentage of total possible points, emphasizing the overriding importance of customer satisfaction, and organizations awarded the Baldrige or Air Force Quality Award are generally recognized for their excellence in customer service. Areas evaluated under customer satisfaction include

- a. customer expectations: current and future
- b. customer relationship management
- c. commitment to customers
- d. customer satisfaction determination
- e. customer satisfaction results
- f. customer satisfaction comparison (15:15; 13:8).

These criteria indicate not only those areas by which a company is judged for competition, but more importantly, those standards by which customers judge the service they receive.

If successfully identifying the service criteria most important to customers is a key factor in outstanding service organizations, then conversely, failing to properly identify those criteria can prove damaging to an organization. The disconnect between customers' service expectations and management's perception of those expectations is often referred to in customer service literature as "the gap" (9:96; 40:2; 3:50). A study by

Becker and Wellins on the important dimensions of customer service demonstrated the gap principle on a broad scale. The researchers asked more than 1300 customers across a variety of industries to rate the importance of certain aspects of customer service. A second survey asked nearly 900 customer service personnel to rate those same aspects with regard to how important they thought the criteria were to the customer. Both sets of ratings were based on a five point scale, with five being the most important. A summary of their findings is shown in Table 1. A review of the results clearly indicates a gap between what customers and service personnel regarded as important service criteria.

TABLE 1  
COMPARISON OF RANKINGS OF IMPORTANT SERVICE CRITERIA

<u>Criteria</u>	<u>Customers Rating</u>	<u>Customer Service Personnel Rating</u>
Job knowledge	1	2
Follow-up	2	3
Communication	3	1
Integrity	4.5	8
Motivation to serve customers	4.5	11
Work standards	6	9.5
Customer sensitivity	7	4
Energy	8	12
Decisiveness	9.5	
Resilience	9.5	6
Judgement	11	7
Impact	12	17
Planning	13	14
Flexibility	14.5	13
Situation Analysis	14.5	9.5
Initiative	16	
Persuasiveness/sales ability	17	15

(3:49-51)

Though Becker and Wellins' study was rather general and cut across a variety of industries, it demonstrated the gap analysis technique often used by specific industries or individual businesses. If "customers are the sole judge of service quality", then gap identification and the implementation of strategies to close the gap are crucial to the success of any service organization (39:29).

In total, the literature revealed that while the importance of very specific service criteria may vary among civilian industries, customers' requirements for reliability, responsiveness, and commitment are generally consistent for any service organization. These criteria often manifest themselves as specific requirements for product or service quality such as acceptable defect rates or service response times. The researchers found no comprehensive federal studies that paralleled those of the civilian sector in which customers were asked to identify the service criteria most important to them.

Once an organization identifies the service criteria most important to its customers, measuring its performance with respect to those criteria is key to evaluating an organization's overall effectiveness. The following section discusses some methods of measuring customer service activities.

## Customer Service Measurements

Experts in both the public and private sectors agree that customer service measures are "one of the means by which a company can operationalize its quality philosophy" and that the measures' payoff is their "ability to define and direct a company's quality improvement efforts" (34:168). In short, "measures support improvement". This is their key purpose" (38:3). Experts also note a distinct difference between customer service measures and productivity or product quality measures, because service is an experience. Because the ultimate goal of this service is customer satisfaction, customer service measures that reflect a customer orientation rather than a management orientation are more effective in driving customer service programs (41:31; 29:8). Warren Blanding, Chairman and CEO of the Customer Service Institute, notes that one reason organizations have a customer service quality problem is that while performance may be measured against standards, all too often management is inappropriately measuring workers' productivity against work standards that have little to do with the quality of customer service (5:236). The following sections examine specific customer service measures in federal and civilian organizations.

Service Measures in Civilian Organizations. In 1976 LaLonde and Zinszer identified the following service measurement categories as some of those most commonly used by manufacturing and merchandising firms: product

availability, order cycle time, consistency, response time, error rates, and distribution system flexibility (30:184, 344). Derivatives of these categories have continued to dominate customer service literature over the past seventeen years, as is evidenced by the following discussion.

The Council of Logistics Management (CLM) proposed that potential measurements for customer service management should include both service quality and service productivity measures, and that the exact definition of those measures will depend on how customer service activities are defined. Service quality measures are intended to evaluate how effectively an organization is meeting customer requirements, while service productivity measures evaluate how efficiently customer service activities are administered (9:388). The CLM suggested quality service measures focus on what the council identified as four key service dimensions: order cycle time, on-time delivery, order accuracy and completeness, and customer communication. These dimensions are considered to be those functions required to provide quality customer service. Each dimension can be examined as to why requirements may not be satisfied. From this examination, potential service measures are identified. For example, one indication of on-time delivery performance is the number of orders not received by customers within a standard time-frame. Reasons for those late orders might be delays in the order entry

process, inventory shortages, etc. Any of the factors related to on-time delivery, including the number of on-time deliveries itself, can become service quality measures.

Development of customer service productivity measures follows the same idea, but productivity measures typically focus on labor, facilities, equipment, and financial investment (9:388-391).

Other studies developed similar measurement identification processes. A Rhea and Schrock study to determine appropriate measures for indicating the effectiveness of physical distribution programs specified the desired outcomes of those programs as effectiveness indicators. Having identified customer satisfaction, (used here interchangeably with customer service), as an indicator, the next step was "operationally defining satisfaction in terms of concepts that are observable and, therefore, can be measured" (41:36). This first required the identification of effectiveness determinants, or factors that could be addressed to see if the desired outcome was achieved. The final step was to identify effectiveness dimensions--those independent variables that are the observable aspects of the effectiveness determinants. Following this methodology and using customer satisfaction as the primary effectiveness indicator, Rhea and Schrock suggested the measurement scheme shown in Table 2 for physical distribution flows.

TABLE 2

EFFECTIVENESS DETERMINANTS AND DIMENSIONS FOR  
PHYSICAL DISTRIBUTION SERVICES

<u>Product Flows</u>		<u>Information Flows</u>	
<u>Determinants: What Should Be Measured</u>	<u>Dimensions: The Measures</u>	<u>Determinants: What Should be Measured</u>	<u>Dimensions: The Measures</u>
Order Cycle Time	Average Consistency/ Variability	Order Procedures/ Entry	Frequency Convenience Efficiency
Lead Times	Length	Invoicing/ Billing	Accuracy Efficiency Timeliness
Inventory	Availability Completeness/ Fill Rate	Customer Service Policy/Promises	Formalization Distribution to Customer
Order Condition	Proximity of Nearest Stock	Order Information	Availability Reliability Timeliness
Emergency Service/ Rush Orders	Accuracy Damage-Free Availability	Inquiries/ Complaints	Preciseness Rapidity Ease Responsiveness

(41:42)

The literature review revealed that many businesses and service organizations use methods similar to the CLM or Rhea and Schrock techniques for determining appropriate customer service measures. Similarly, many of the factors originally identified by LaLonde and Zinszer as well as by both the CLM and Rhea and Schrock studies are commonly used as measures of customer service. A 1989 Michigan State University study of leading edge logistic firms determined that on the average, within leading manufacturers, wholesalers, retailers, and hybrid businesses, the following customer service measures were used:

TABLE 3  
CUSTOMER SERVICE MEASURES USED BY  
LEADING EDGE LOGISTICS FIRMS

<u>Measure</u>	<u>Percent of Firms Using Measure</u>
Customer Feedback	87
Shipping Errors	79
On-Time Delivery	74
Fill Rate	69
Backorders	67
Stockouts	55
Cycle Time	52

(6:139)

One should note that these figures represent the average use of each measure among the four types of businesses surveyed, and that some industries typically employ certain measures more or less often than other industries. For example, though it appears that cycle time is only used by just over half of the firms surveyed, ninety percent of the manufacturers studied employed cycle time as a customer service measure (6:139).

Many of the findings referenced thus far, as well as the results of other similar but independent studies of logistics and service industries, closely correspond to those of the Michigan State study (45:152; 38:xii-xv). It is apparent how many of these measures pertain to a wide variety of businesses and services, including services with characteristics similar to those of Vehicle Maintenance. For example, some of the most routinely identified measures, such as customer feedback, on-time delivery, cycle time, and defects, are all customer service measures that could easily

be employed in evaluating Vehicle Maintenance's performance.

Service Measures in Federal Organizations. Methods for developing customer service measures in federal agencies are much the same in theory as those used in the civilian sector. The President's Council on Management Improvement writes that

Data should be collected on features of customer satisfaction such as responsiveness, reliability, accuracy, and ease of access. The measurement systems should also focus on internal processes, especially on processes that generate variation in quality and cycle time. When customer data indicate a problem, or when the organization wants to raise the level of customer satisfaction, the organization should try improving the processes that deliver the product or service. (42:8)

Similarly, the Federal Quality and Productivity Improvement Program of the Office of Management and Budget (OMB) classifies all service measures as being external (product/service) or internal (process) measures of quality and timeliness. Examples of quality service measures used in public sector agencies closely parallel those identified in the civilian sector (37:2-20; 38:xvi-xviii; 39:3-38).

The OMB offers a number of quality customer service measures used in government maintenance agencies including agencies of the DOD and Air Force. Those measures include

- a. defects generated per unit of equipment or per production hour
- b. the percent of maintenance work that is repeated or called back
- c. the percent of equipment downtime due to maintenance failure

- d. the ratio of maintenance actions completed on schedule to the number of maintenance actions scheduled to be completed (38:xvii).

Specific examples of such measures are those established for Air Force Vehicle Maintenance units in AFM 77-310 and under the On-Line Vehicle Integrated Management System program, both of which are discussed in Chapter I. The researchers note, however, that at the time of this writing certain Vehicle Maintenance units are using new measurement criteria that focus primarily on vehicle turn-around time (cycle time) (48). The long-term effectiveness of this new measurement cannot yet be determined. Research shows, however, that cycle time measures, when not used in conjunction with measures of defects per unit, can be ineffective and even counterproductive. Both measures must be used simultaneously. It is intuitive that an organization "could improve performance on one by ignoring the other. That is, cycle time could be reduced by not doing the job correctly in the first place" (20:35).

The literature review of federal customer service measures also revealed that, while customer inputs should be considered in the development of service measures, there was no available evidence of any formal assessment of customer requirements. Unlike the civilian organizations and studies reviewed, the federal literature offered only generic measurement development strategies and gave no specific background on the development of any single measure. Of particular interest to the researchers was the lack of

information concerning customer inputs or the justification for the present Air Force Vehicle Maintenance performance measures, hence the research problem that is the basis of this study.

### Summary

The objective of this literature review was to examine and synthesize the ideas presented in the customer service literature that were relevant to this research. The specific areas addressed were 1) the definitions of customer service, 2) past customer service research studies, 3) the importance of customer service, 4) customer service criteria, and 5) measures of customer service.

A number of common ideas can be drawn from both the civilian and federal literature on customer service. To summarize,

- a) there are a wide variety of definitions of customer service, the most comprehensive of which are based on the needs of the customer and lend themselves to some form of measurement
- b) previous research in the civilian sector and an increased focus on DOD and Air Force quality initiatives have highlighted the importance of customer service
- c) managers too often mistake productivity measures for quality service measures
- d) customer service measures must have customer satisfaction as their primary focus, and customer inputs must be considered in establishing measures; therefore measures are directly related to the service criteria identified as important to the customer

- e) order cycle time, response time, defect rate, and product and/or information availability are among the most common generic measures of quality customer service in both civilian and federal organizations.

While these ideas do not address every aspect of customer service, no comprehensive study of customer service measures would be complete without considering these points. Thus, these concepts help build a foundation for this research effort and provide guidance in the search for a more comprehensive set of Vehicle Maintenance performance measures that provide an overall assessment of service quality. Using adaptations from the various methodologies examined in this literature review, the researchers will solicit inputs from Vehicle Maintenance customers across ACC to determine the service criteria against which Vehicle Maintenance performance should be measured. Areas to be specifically examined with respect to customers' perceptions were drawn from the literature as well. Those areas are general service (i.e. flexibility, responsiveness, etc.), information availability, professionalism, timeliness of maintenance, and quality of maintenance. Chapter III will address the specific research methodology used in this study.

### III. Methodology

This chapter presents a description of the methodology used to answer the research questions. The research design for this study was patterned after the methodologies of leading experts in the field of customer service. Specifically, Sterling and Lambert's 1987 study and the Lambert and Harrington's 1989 study were modified and adapted for this research. Both of these research projects focused on determining variables used by customers to evaluate service provided by suppliers and consisted of the following elements: 1) an external audit of customers to determine the customer service variables important to the customer; 2) an internal audit to determine existing customer service standards and if/how service to the customer was measured; 3) a mail survey to evaluate customers perceptions; and 4) analysis to identify areas or services which offered the best opportunity for improvement (32:46). A complete discussion of these research projects and their findings is presented in Chapter II. For the purpose of this research, the methodology consisted of seven elements: 1) literature review, 2) population and sample identification, 3) external audit, 4) survey design, 5) pretest, 6) survey distribution and data collection, and 7) data analysis. The researchers' knowledge of Vehicle Maintenance management coupled with the customer service criteria identified during the literature review eliminated

the need to conduct an internal audit. The remainder of this chapter addresses each step of the research methodology.

### Literature Review

The objective of the literature review was to gain insight into customer service, examine existing customer service measures, and to determine customer service criteria. The literature reviewed provided a solid foundation for this research and guided the researchers through the development and design of an assessment tool for Vehicle Maintenance customer service.

### Population and Sample Identification

The objective of this research was to recommend a more comprehensive set of Vehicle Maintenance performance measures that integrate the ideas of product quality and customer service to provide an overall measure of service quality. To meet this objective, the researchers conducted a survey of Vehicle Maintenance customers to answer the investigative questions outlined in Chapter I. The population of interest was all Vehicle Maintenance customers, but sampling was limited to ACC customers for two reasons. First, there are no contract Vehicle Maintenance units in the command. The customer service level provided by contract maintenance units is, in part, dictated by the nature of the contract. To include such a unit in this study might have biased the research results. Second, ACC

consists of former TAC and SAC bases, providing a good mix of units with a variety of missions requiring various levels of Vehicle Maintenance support. The research sample therefore was a nonprobability purposive sample limited to specific customers at ACC bases in the Continental United States. Only bases expected to be operational after 31 December 1993 were surveyed.

Although the majority of ACC organizations are supported by transportation services, it was the intent of this research to survey only those customers from the organizations that are most affected by or that regularly interact with Vehicle Maintenance. Those major customers are defined as organizations with proportionally large vehicle fleets or that contribute significantly to the Vehicle Maintenance workload. In ACC, those organizations are Civil Engineering (CES), the Security Police (SPS), Supply (SUPS), Transportation Vehicle Operations (TRV), and the aircraft maintenance units from both the Logistics and Operations Groups. In total, the vehicles belonging to these organizations comprise approximately 70 percent of an average vehicle fleet.

The sample population was further defined to include the Commander, Vehicle Control Officer (VCO), and Vehicle Control Noncommissioned Officer (VCNCO) from each sampled organization. These individuals have a thorough understanding of their organizations' vehicle support

requirements as well as an informed opinion of how well Vehicle Maintenance is meeting those requirements.

#### External Audit

The specific objective of this phase of the research was to identify customer service criteria important to ACC Vehicle Maintenance customers. To gather basic information concerning areas of interest to Vehicle Maintenance customers, informal telephone interviews were conducted with fifteen customers (specifically commanders, VCOs, and VCNCOs) selected at random from throughout ACC. Additionally, informal personal interviews were conducted with ten Air Force officers currently enrolled in the Air Force Institute of Technology (AFIT) Graduate Logistics Management program. AFIT students were selected based on whether their assignment prior to AFIT was in SAC or TAC and whether, during that assignment, they acted as a commander or VCO or had routine involvement with Vehicle Maintenance issues or the base Vehicle Maintenance organization. A preliminary list of questions was prepared to facilitate and standardize the interviews. Information gathered during the interviews was used in the formulation of survey questions.

#### Survey Design

An anonymous mail survey was determined to be the most efficient method of data collection due to the geographic location of ACC bases and time limitations. Questions were designed using examples from previous AFIT theses on

customer service, information gathered during the informal interviews, and information from the various sources reviewed in Chapter II. In particular, the customer satisfaction measures used by Sterling and Lambert, Stock and Lambert, and LaLonde and Zinszer were modified for this survey. A preliminary survey was developed and consisted of four parts:

a. Part A was designed to collect demographic and administrative data that would enable the statistical analysis necessary to answer specific investigative questions. The specific data requested were organization of assignment, rank, size of the vehicle fleet for which the respondent is responsible, and the primary type/class of vehicle for which the respondent is responsible. The researchers identified prior major command assignment by tracking the distribution of pre-coded answer sheets.

b. Part B was divided into five sections, each of which targeted a specific customer service attribute. The first section, General Service, was designed to evaluate Vehicle Maintenance's responsiveness and flexibility to the customers' needs. Information Availability, the second section, evaluated the reliability and accuracy of information provided by Vehicle Maintenance. Professionalism of Vehicle Maintenance Personnel was surveyed in the third section. Maintenance processing and repair times were the primary focus of the fourth section, Vehicle Maintenance Timeliness. The final section, Vehicle

Maintenance Quality, evaluated the quality and reliability of Vehicle Maintenance's repairs.

In each section, respondents were first asked to rate the importance and observed frequency of customer service criteria. Ratings for importance and frequency were done concurrently to eliminate question duplication in the survey. Each question first asked respondents to rate, on a seven point ordered metric scale, the importance they would assign to each criterion. The importance ratings were

- 1 - Of No Importance
- 2 - Of Very Minor Importance
- 3 - Moderately Important
- 4 - Of Average Importance
- 5 - Very Important
- 6 - Of Major Importance
- 7 - Critically Important

Next, respondents were asked to rate the observed frequency with which Vehicle Maintenance performs each of the criterion, again using a seven point ordered metric scale.

Frequency ratings were

- 0 - Not Applicable
- 1 - Never (0% of the time)
- 2 - Seldom (1 - 20% of the time)
- 3 - Sometimes (21 - 40% of the time)
- 4 - About Half (41 - 60% of the time)
- 5 - Usually (61 - 80% of the time)
- 6 - Mostly (81 - 99% of the time)
- 7 - Always (100% of the time)

The researchers believed that respondents would rate all or most of the customer service criteria as equally important. Therefore, within each section, the respondents were also asked to rank the criteria in order of importance and perceived performance.

c. Part C asked the respondents to rank order the general customer service attributes (i.e., General Service, Information Availability, Professionalism of Vehicle Maintenance Personnel, Vehicle Maintenance Timeliness, and Maintenance Quality) by their importance and perceived performance.

d. Part D asked four open-ended questions about customer service and provided the customer an opportunity to respond outside the confines of the computerized scan sheet.

### Pretest

The preliminary survey was pretested to verify the clarity and validity of the measurement tool. The researchers were specifically interested in verifying the survey's content validity, or the extent to which the questions provided adequate coverage of the subject. To evaluate the preliminary survey, twenty-five AFIT students previously assigned to maintenance, supply, transportation, and civil engineering organizations and personnel assigned to the ACC Transportation Directorate participated in a pretest. The preliminary survey contained demographic questions, customer service ordered metric and rank-ordered

response questions, and open-ended customer service questions. Pretest participants were asked to complete the survey and identify any areas that were too vague or areas that should have been included in the survey. Following the pretest, respondents' comments were reviewed and evaluated, and in some cases, the respondents were interviewed. The preliminary survey was edited, and the final survey was developed. The final survey appears in Appendix A.

#### Survey Distribution and Data Collection

Surveys were distributed to respondents through the base Vehicle Maintenance Officers (VMOs). Prior coordination with the ACC Transportation Directorate and base transportation commanders enabled the researchers to contact the VMOs directly with instructions on survey distribution procedures. VMOs distributed surveys to the CES, SPS, SUPS, TRV, and aircraft maintenance unit VCOs. The VCOs were instructed to complete one survey themselves and to distribute the remainder between the unit commander and other unit vehicle control personnel. The specific survey quantities required for each base were determined by the number of personnel assigned to the vehicle control function within each squadron, and a total of 853 surveys were distributed. Each survey package included an instruction sheet and pre-addressed envelope.

Surveys were mailed to VMOs on 30 April 1993 with an 11 June 1993 return deadline. The researchers monitored the

survey returns and made follow-up telephone calls to encourage response.

### Data Analysis

Data analysis was structured to answer the specific objectives and investigative questions outlined in Chapter I. Specifically, responses to parts B and C of the survey were compared for differences among respondent groups. Data was analyzed using Statistical Analysis Software (SAS®). Cronbach's Alpha was used to test the reliability of all ordered metric response items. Answers to unreliable items were considered for elimination from the response data set before the comprehensive data analysis was conducted.

To determine whether parametric analysis was appropriate for this study, the following assumptions were tested:

- a. all sample population probability distributions were normal
- b. the sample variances were equal
- c. the sample was randomly selected
- d. measurement scales were at least interval (35:870; 21:530).

Assumption (a) was tested using the NORMAL option of the UNIVARIATE procedure. Histograms were constructed to obtain visual representations of the frequency distributions of customer groups. Assumption (b) was tested using the UNIVARIATE PLOT procedure. Additionally, the UNIVARIATE

procedure was used to calculate descriptive statistics for each general attribute (mean, standard deviation, and variance) as well as to test the assumption of normal population distributions. Assumption (c) was made in accordance with the rules necessary to perform parametric analysis, even though this was a nonprobability purposive sample. However, the researchers concluded that a violation of this assumption was unlikely to bias the results of the analysis, since each respondent answered independently of the others. Additionally, the ANOVA procedure was used to confirm that the respondent segments were sufficiently balanced to provide statistically significant results. Finally, although ordinal data were collected, the researchers assumed that the data could be treated as interval and the appropriate parametric tests conducted.

Test results did not support the assumptions listed above, therefore, the researchers used nonparametric techniques to determine whether statistically significant differences existed between customer groups as described in the hypotheses below. Specifically, Kruskal-Wallis tests were used to identify differences in how respondent groups ranked the importance and performance of the general customer service attributes and the criteria associated with each attribute. Kruskal-Wallis tests were also used to identify significant differences in respondent groups' ratings of the importance and observed frequency of the general customer service attributes. The researchers tested

only for main effects. Figure 2 summarizes these research design tests. All analyses and tests were conducted at a .05 level of significance.

Hypotheses were formulated in accordance with the investigative questions set forth in Chapter I. In each hypothesis, the phrase "customer service elements" refers to both the general customer service attributes and the criteria listed under each attribute:

H<sub>0</sub>1a: There are no significant differences between customer segments from prior SAC and TAC bases with regard to their identification of the importance of customer service elements.

H<sub>0</sub>1b: There are no significant differences between customer segments from prior SAC and TAC bases with regard to their identification of the performance of customer service elements.

H<sub>0</sub>2a: There are no significant differences between customers segmented by organization of assignment (CES, SPS, SUPS, TRV, Aircraft Maintenance) with regard to their identification of the importance of customer service elements.

H<sub>0</sub>2b: There are no significant differences between customers segmented by organization of assignment with regard to their identification of the performance of customer service elements.

H<sub>0</sub>3a: There are no significant differences between customers segmented according to vehicle fleet size of the respondent's organization (1-50, 51-100, 101-150, 151+) with regard to their identification of the importance of customer service elements.

H<sub>0</sub>3b: There are no significant differences between customers segmented according to vehicle fleet size of the respondent's organization with regard to their identification of the performance of customer service elements.

H.4a: There are no significant differences between customers segmented by rank (Field Grade Officer, Company Grade Officer, Senior NCO, NCO, Airman) with regard to their identification of the importance of customer service elements.

H.4b: There are no significant differences between customers segmented by rank with regard to their identification of the performance of customer service elements.

H.5a: There are no significant differences between customers segmented according to the type/class vehicle operated (general purpose, refueling, firefighting, materials handling, LE sedans, flightline tow, other special purpose) with regard to their identification of the importance of customer service elements.

H.5b: There are no significant differences between customers segmented according to the type/class vehicle operated with regard to their identification of the performance of customer service elements.

### Summary

This chapter presented the specific research methodology developed and used for this study. Drawing from ideas uncovered in the literature review, the research design was adapted from the previous studies of Sterling and Lambert and Lambert and Harrington. Survey design, pretest, distribution, and data collection were also discussed. Finally, statistical analysis of the data was described. Initial tests did not support the assumptions necessary for parametric analysis; therefore, the researchers used nonparametric techniques to test for differences in how respondents rank ordered and rated the customer service elements. The results of this analysis are presented in Chapter IV.

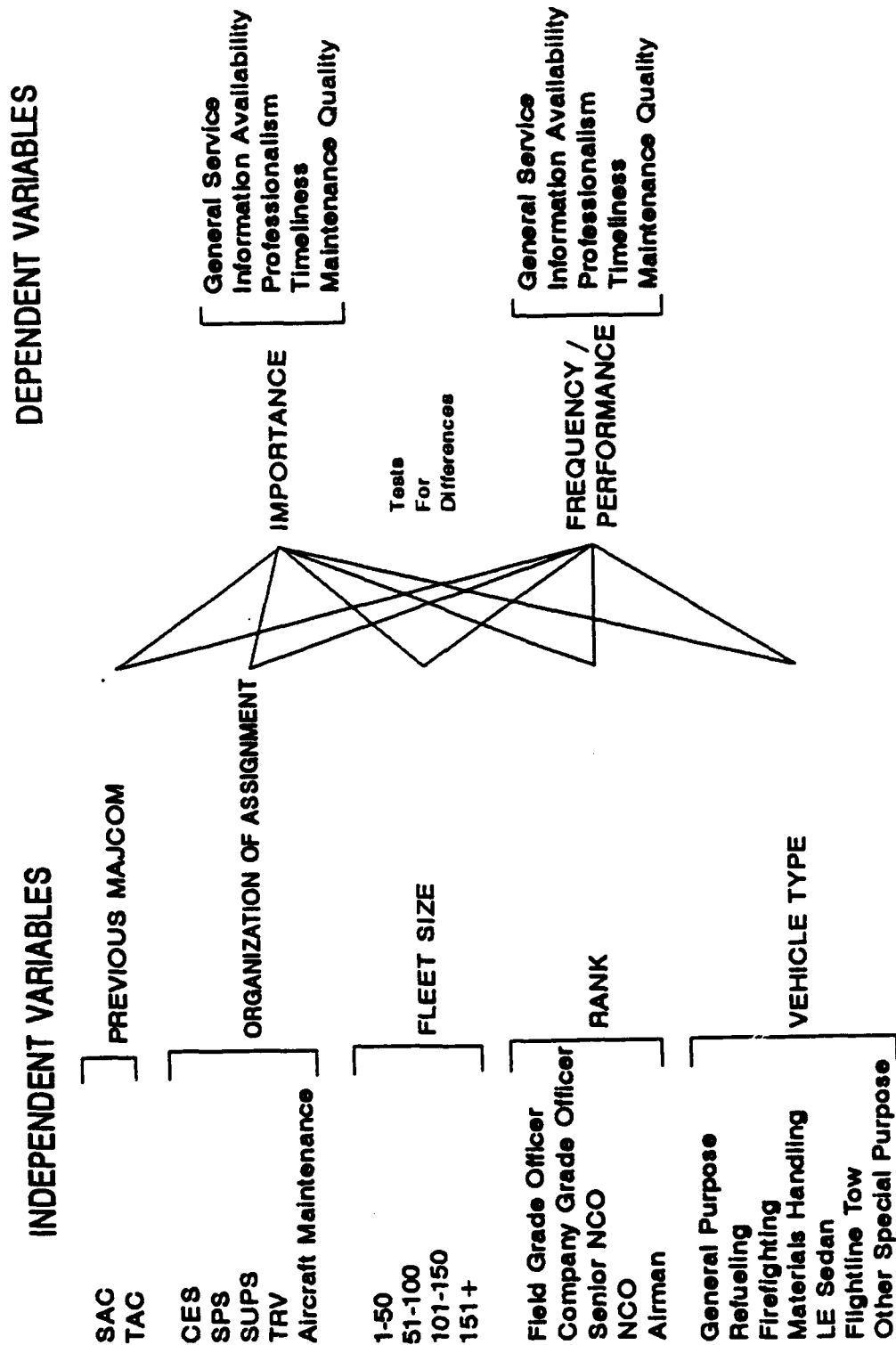


Figure 2. Research Design Tests

#### IV. Results and Analysis

This chapter presents the results and analysis of the data as described in Chapter III and is divided into several sections. The survey response rate is discussed first, followed by the results of the reliability analysis. Next, the sample distributions and the associated assumptions from Chapter III are discussed. Results and analysis of the nonparametric and parametric tests are then presented as they relate to the investigative questions from Chapter I. Finally, the written comments from survey respondents are addressed.

##### Survey Response Rate

As stated in Chapter III, 853 surveys were distributed to the Vehicle Maintenance customers of interest. Of these, 466 surveys were returned, 458 of which were usable and provided a 54 percent effective response rate. The confidence level for results of the analysis was calculated to be 99.02 percent based on the following formula and the sample size:

$$n = \frac{N(z^2) * p(1-p)}{(N-1)(d^2) + [(z^2) * p(1-p)]} \quad (1)$$

where

n = sample size (458)  
N = population size (853)  
p = maximum sample size factor (.5)  
d = desired tolerance (.05)  
z = factor of assurance (the unknown)  
(25:12)

### Reliability Analysis

Cronbach's Alpha tests were used to ensure the reliability of the ordered metric measurement items. Analysis generated Cronbach coefficients of reliability ranging from .77 to .94 for the importance and frequency measures of the customer service attributes, indicating a generally high reliability among items designed to measure those attributes. Tests indicated two cases in which the reliability of specific measures was questionable. Analysis revealed that item numbers 103 and 104, the importance and frequency ratings for "Fixes only customer identified vehicle discrepancies each visit", were possibly unreliable measures of Vehicle Maintenance Quality. Removal of those specific measures significantly improved the Cronbach coefficients for the overall importance and frequency measures of Vehicle Maintenance Quality. However, the researchers were not certain that the lower Cronbach coefficients associated with items 103 and 104 could be attributed to an unreliability of those measures. Besides indicating the items were not measuring the same construct as their associated measures, the lower coefficients could also mean that respondents as a whole rated these items significantly higher or lower than the other criteria associated with Vehicle Maintenance Quality. Considering this possibility, the researchers decided to include responses to items 103 and 104 in their analysis. A summary

of the reliability coefficients for the composite variables is presented in Table 4.

TABLE 4  
RELIABILITY COEFFICIENTS FOR COMPOSITE VARIABLES

<u>Variable</u>	<u>Question Numbers</u>	<u>Cronbach's Alpha</u>	
General Service			
Importance	5, 7, 9, 11, 13, 15	.77	
Frequency	6, 8, 10, 12, 14, 16	.81	
Information Availability			
Importance	29, 31, 33, 35, 37, 39	.87	
Frequency	30, 32, 34, 46, 40, 40	.86	
Professionalism of Maintenance Personnel			
Importance	53, 55, 57, 59, 61, 63	.91	
Frequency	54, 56, 58, 60, 62, 64	.94	
Vehicle Maintenance Timeliness			
Importance	77, 79, 81, 83, 85, 87	.90	
Frequency	78, 80, 82, 84, 86, 88	.89	
Vehicle Maintenance Quality			
Importance	101, 103, 105, 107, 109	.75	.88*
Frequency	102, 104, 106, 108, 110	.85	.90**

\* Cronbach's Alpha without item 103

\*\*Cronbach's Alpha without item 104

#### Sample Distribution and Assumptions

As specified in Chapter III, four assumptions were required to perform parametric data analysis.

Assumption (a), the assumption of normality for all sample population probability distributions, was tested using UNIVARIATE analysis. Test results indicated that respondent group probability distributions were not normal. Therefore,

the researchers determined parametric techniques were inappropriate for this analysis and all tests were conducted using nonparametric techniques. Histograms of the respondents' demographic characteristics (organization, rank, fleet size, type/class vehicle operated, and prior MAJCOM) are presented in Appendix B.

### Analysis Overview

Analysis of the survey data was done in three phases. First, rank-ordered data for the importance and performance customer service attributes and their associated criteria were analyzed for the entire sample using comparisons of means. Next, the researchers tested for differences in how various customer groups rank ordered the importance and performance of those same attributes and criteria. Finally, the ordered metric data were analyzed for differences between how customer groups rated the importance and frequency of the customer service attributes. All analysis required Kruskal-Wallis tests which were conducted at the .05 significance level.

### Customer Service Elements--Importance and Performance

#### Investigative Question 1

What customer service elements are most important to ACC Vehicle Maintenance customers?

To answer this question, the researchers first analyzed the rank-ordered responses for the importance of the

customer service attributes (General Service, Information Availability, Professionalism of Vehicle Maintenance Personnel, Vehicle Maintenance Timeliness, and Vehicle Maintenance Quality) for the entire sample. Results of the rank ordering for importance are presented in Table 5. The table is structured to present the attributes in order of importance with 1 being the most important and 5 being the least important. All subsequent tables for ranked data are structured in the same manner. Mean scores are provided to give the reader an indication of the relative differences between the ranked items. The closer the mean rank score is to 1, the more important the item.

TABLE 5  
IMPORTANCE RANKINGS FOR CUSTOMER SERVICE ATTRIBUTES  
FOR THE ENTIRE SAMPLE

<u>Item</u>	<u>Order of Importance</u>	<u>Mean Score</u>
Vehicle Maintenance Quality	1	1.54
Vehicle Maintenance Timeliness	2	2.14
General Service	3	3.45
Professionalism of Vehicle Maintenance Personnel	4	3.66
Information Availability	5	4.21

Table 5 identifies the general attributes customers found important. The relatively high mean scores for Vehicle Maintenance Quality and Timeliness indicate that customers have definite preferences for these two service attributes. Closer evaluation of the table also indicates a

clear gap between customer preferences for quality and timeliness and the remaining three attributes.

To further investigate the elements important to the customers, the researchers analyzed the specific criteria under each of the attributes. Table 6 lists the general attributes in order of importance (as discussed earlier), and then lists the top two criteria under each of the attributes. For complete listings of the criteria in order of their importance, see Appendix C.

TABLE 6  
IMPORTANCE RANKINGS FOR CUSTOMER SERVICE CRITERIA  
FOR THE ENTIRE SAMPLE

<u>Item</u>	<u>Order of Importance</u>	<u>Mean Score</u>
<u>Vehicle Maintenance Quality</u>		
Provides quality vehicle repairs	1	2.10
Fixes vehicle discrepancies the first time	2	2.48
<u>Vehicle Maintenance Timeliness</u>		
Minimizes vehicle repair time	1	2.26
Minimizes total vehicle maintenance processing time	2	2.77
<u>General Service</u>		
Takes appropriate action to resolve problems when they occur	1	2.02
Consistently meets my organization's service needs	2	2.69
<u>Professionalism of Vehicle Maintenance Personnel</u>		
Displays a willingness to help	1	2.31
Displays concern for customers	2	2.47
<u>Information Availability</u>		
Provides information on projected vehicle repair completion times	1	2.07
Provides information on scheduled maintenance	2	2.64

Tables 5 and 6 identify the attributes and criteria customers deem most important. These results will be used in the analysis of the second investigative question.

### Investigative Question 2

How do customers perceive the performance of ACC Vehicle Maintenance organizations with respect to those elements identified as important?

To answer this question, the researchers first analyzed the rank-ordered responses for Vehicle Maintenance's performance of the customer service attributes for the entire sample. Next, the researchers used nonparametric Kruskal-Wallis tests to identify differences between the respondents' importance and performance rankings of the customer service attributes at a .05 significance level. These differences provided the foundation for answering both this question and Investigative Question 3 and are presented in Table 7.

TABLE 7

#### IMPORTANCE AND PERFORMANCE RANKINGS FOR ATTRIBUTES FOR THE ENTIRE SAMPLE

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>	<u>Mean Score Importance</u>	<u>Mean Score Performance</u>
Vehicle Maintenance Quality	1	2	1.54	2.91 *
Vehicle Maintenance Timeliness	2	5	2.14	3.34 *
General Service	3	1	3.45	2.54 *
Professionalism of Vehicle Maintenance Personnel	4	3	3.66	2.98 *
Information Availability	5	4	4.21	3.20 *

\* Significant differences between mean ranked importance and performance scores at  $\alpha=.05$

In comparing the results of the rank-ordered importance and performance tests, the researchers noted several differences. Although Vehicle Maintenance Quality and Vehicle Maintenance Timeliness were ranked as the two most important attributes, they were only ranked second and fifth respectively on the performance scale. This implies that Vehicle Maintenance customers want both high quality and timely service but perceive they are not getting timely service. The item ranked as best performed (General Service) was ranked third on the importance scale. A review of the specific General Service criteria reveals that all these criteria evaluate areas involving direct interaction with the customers and Vehicle Maintenance's responsiveness to customers' specific needs. A high performance ranking in this area would seem to indicate that the recent Air Force and ACC emphasis on quality is having a positive affect on the personal interaction skills of Vehicle Maintenance personnel. However, its ranking as only the third most important attribute indicates that Vehicle Maintenance must concentrate more of its quality efforts on the items customers ranked as most important (Vehicle Maintenance Quality and Vehicle Maintenance Timeliness).

Finally, the researchers compared the mean ranks to determine the degree of variation between the rankings. Mean ranks were calculated using the following equation:

$$\bar{x} = \frac{\sum \text{Scores}}{n} \quad (2)$$

where

$\Sigma$  = Sum of scores

n = Number of responses for the item

A review of the mean ranked performance scores reveals that, despite the attributes' rankings from best to least adequately performed, on the average, customers did not rank any specific items as being particularly well or particularly poorly performed. Rather, the mean scores fall between 2.54 and 3.34 and indicate that Vehicle Maintenance's performance for all the attributes varies only slightly, and that customers perceive their overall performance as average.

To further investigate Vehicle Maintenance's performance with regard to the importance criteria, the researchers analyzed the criteria under each of the performance attributes to determine the specific criteria the customers identified as best performed. The researchers then compared the top two importance criteria for each attribute (Table 6) against their ranking on the performance scale and tested for statistically significant differences between the two. Table 8 displays a comparison of the top two importance criteria and their performance rankings. As in previous tables, the general attributes are listed in order of importance. For complete listings of the criteria in order of their performance, see Appendix C.

TABLE 8

IMPORTANCE AND PERFORMANCE RANKINGS FOR CRITERIA  
FOR THE ENTIRE SAMPLE

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>	<u>Mean Score Importance</u>	<u>Mean Score Performance</u>
<u>Vehicle Maintenance Quality</u>				
Provides quality vehicle repairs	1	1	2.10	2.83 *
Fixes vehicle discrepancies the first time	2	4	2.48	3.17 *
<u>Vehicle Maintenance Timeliness</u>				
Minimizes vehicle repair time	1	5	2.26	3.85 *
Minimizes total vehicle maintenance processing time	2	4	2.77	3.72 *
<u>General Service</u>				
Takes appropriate action to resolve problems when they occur	1	1	2.02	2.56 *
Consistently meets my organization's service needs	2	4	2.69	3.17 *
<u>Professionalism of Vehicle Maintenance Personnel</u>				
Displays a willingness to help	1	3	2.31	3.35 *
Displays concern for customers	2	4	2.47	3.60 *
<u>Information Availability</u>				
Provides information on projected vehicle repair completion times	1	2	2.07	3.29 *
Provides information on scheduled maintenance	2	1	2.64	2.21 *

\* Significant differences between mean ranked importance and performance scores at  $\alpha=.05$

In comparing the importance and performance criteria, the researchers identified several differences. As shown in Table 8, the top two criteria in all areas showed significant statistical differences in the importance and performance rankings. Of the twenty-nine total criteria, only two criteria for Information Availability and one criterion for General Service had importance or performance rankings that were not identified as significantly

different. The statistically significant differences between the mean scores for these rankings could indicate that even though a criterion has similar importance and performance rankings, on the average, one ranking was generally higher than the other. For example, the item "Takes appropriate action to resolve problems when they occur" was ranked as the most important and best performed General Service attribute. However, its mean rank score for importance was significantly lower than its mean rank score for performance, indicating that while this item ranked first in both importance and performance, customers overall ranked its importance higher than they did its performance.

For the remaining criteria, there is a more obvious deviation between importance and performance rankings. For example, under Vehicle Maintenance Timeliness, the criterion "Minimizes vehicle repair time" was ranked first (Most Important) on the importance scale. However, it was ranked fifth (of six) on the performance scale. This clearly displays a difference between what the customers want (minimum repair time) and what they actually receive.

To answer Investigative Question 2, analysis of the comparison data for both the general attributes and the criteria under the attributes indicated that customers do not yet perceive that Vehicle Maintenance is meeting their needs in the areas they deem important. Certainly, Vehicle Maintenance is meeting some of the customers' needs, but the significant discrepancies between the first and second

importance and performance rankings indicate that improvements are still necessary.

It should be noted that the rankings of the top two performance attributes--General Service and Vehicle Maintenance Quality--could be closely related to the quality initiatives employed by the Air Force and ACC in the past few years. The literature review identified that since the onset of TQM, top DOD officials have focused on quality performance and service. The data presented here indicate that these initiatives are being implemented at base level.

Investigative Question 3

Are ACC Vehicle Maintenance organizations meeting customers' expectations?

To answer Investigative Question 3, the researchers assumed that the attributes and criteria the customers ranked as important were also the items they expected to receive from Vehicle Maintenance. As discussed in Investigative Questions 1 and 2, customers identified those attributes and criteria important to them and how they perceived Vehicle Maintenance's performance in those same areas. As Table 8 indicates, there is a difference between those attributes and criteria customers find most important and their perceptions of Vehicle Maintenance's performance in those same areas. Specifically, and perhaps most obviously, high importance and low performance rankings for Vehicle Maintenance Timeliness and its associated criteria

indicate that Vehicle Maintenance is failing to provide its customers with the timely service they desire. As discussed earlier, the overall rankings indicate that Vehicle Maintenance customers want both high quality and timely service, but perceive they are not getting timely service. Other discrepancies might indicate similar problem areas. For example, the General Service importance ranking of 3 and performance ranking of 1 could imply that Vehicle Maintenance's customer service efforts are not producing what customers feel is most important. It might also indicate that efforts are appropriately focused, but that Vehicle Maintenance Management lacks sufficient resources or tools to support those efforts.

There are a number of possible reasons for discrepancies between attribute and criteria importance and performance rankings. The specific reasons are beyond the scope of this research. However, based on this analysis, the researchers can conclude that Vehicle Maintenance is not meeting its customers' highest expectations.

#### Differences Between Customer Groups

While rankings for the entire population provided useful information, the researchers were also interested in determining if responses differed between specific customer groups. Such differences could provide Vehicle Maintenance managers with information to guide them in focusing their customer service efforts--and the associated measures--to

meet specific customer groups' needs. This was the focus of Investigative Questions 4 and 5 as presented below:

**Investigative Question 4**

Are there differences in what Vehicle Maintenance customers identify as important customer service elements based on the

- a. base's previous Major Command assignment (SAC/TAC)
- b. respondent's organization of assignment
- c. vehicle fleet size of the respondent's organization
- d. respondent's rank
- e. primary type/class of vehicle operated

**Investigative Question 5**

Are there differences in customers' perceptions of Vehicle Maintenance performance based on the

- a. base's previous Major Command assignment (SAC/TAC)
- b. respondent's organization of assignment
- c. vehicle fleet size of the respondent's organization
- d. respondent's rank
- e. primary type/class of vehicle operated

To guide the analysis, the hypotheses presented in Chapter III were developed from Investigative Questions 4 and 5. Hypotheses were structured according to customer groups and were designed in pairs. The first hypothesis in each pair tested for differences in how the customer groups assessed the importance of the customer service elements. The second hypothesis investigated whether there were differences in how customers perceived Vehicle Maintenance's performance in those areas. Nonparametric Kruskal-Wallis

tests were selected and structured to specifically analyze the data and answer the hypotheses. This section examines the test results for those hypotheses. All tests were conducted at the .05 significance level.

For each pair of hypotheses, the data was analyzed in three steps. The first step was to determine if the respondent groups significantly differed in their ordered metric ratings of the importance and/or displayed frequency of the customer service attributes (note that frequency refers to "how often" while performance refers to "how well"). Ordered metric ratings for each item were assigned according to the seven point scale described in Chapter III. Because of the strong possibility that respondents would rate all or most of the customer service attributes as critically important, the respondents were also asked to rank order the attributes from most important/best performed to least important/least adequately performed. The next step, then, was to determine if there were significant differences in how respondent groups rank ordered the importance and/or performance of the customer service attributes. The third step was to determine if the customer groups differed in their importance and/or performance rankings of the specific criteria pertaining to each of the attributes.

To facilitate discussion of the analysis, the remainder of this chapter is presented according to the research hypotheses. The discussion following each pair of

hypotheses focuses on the three step analysis discussed above. For each hypotheses pair, differences between how customer groups rank ordered the importance and/or performance of the customer service attributes are discussed first. Next, differences in how customer groups rank ordered the importance and/or performance of the specific criteria pertaining to each attribute are presented. Then, differences in customer groups' ordered metric ratings for the importance and/or observed frequency of the attributes are examined. Finally, the researchers present some general observations concerning the test results as they relate to each hypotheses pair.

**H<sub>0</sub>1a: There are no significant differences between customer segments from prior SAC and TAC bases with regard to their identification of the importance of customer service elements.**

**H<sub>0</sub>1b: There are no significant differences between customer segments from prior SAC and TAC bases with regard to their identification of the performance of customer service elements.**

The researchers were interested in determining if customers from prior TAC and SAC bases placed different emphasis on customer service elements, possibly reflecting differences in the prior command missions, quality program emphasis, training, etc. Nonparametric tests did reveal statistically significant differences between how respondents from the two MAJCOMs ranked the overall importance and performance of two of the general customer

service attributes. Those differences are presented in Table 9.

TABLE 9  
DIFFERENCES IN **ATTRIBUTE RANKINGS** BY PRIOR MAJCOM  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	Kruskal-Wallis Mean Rank Sums (TAC / SAC)
Professionalism of Vehicle Maintenance Personnel <b>Performance</b>	158.47 / 180.50
Information Availability <b>Importance</b>	157.85 / 186.01

As stated in Chapter III, SAS<sup>®</sup> was used for all data analysis. To calculate the mean rank sum for the Kruskal-Wallis tests, all responses were first organized into rank order from highest to lowest. Next, the ranked positions for the responses from a particular customer group were summed and the total was divided by the number of respondents from that group. For example, suppose there were 50 respondents for a particular item, and only two of those respondents were from SAC. Also suppose that the two SAC respondents ranked the item higher than all other respondents. These responses would be ranked in the highest two positions and would therefore be assigned ranked scores of 49 and 50. Therefore, SAC's mean rank sum would be 49.5  $([49+50]/2)$ . The equation for the mean rank sum is

$$\bar{X} = \frac{\sum \text{Scores}}{n} \quad (3)$$

where

$\Sigma$  = Sum of ranked position scores  
 n = Number of respondents for the item

This process explains the unusually high mean sum scores for all the Kruskal-Wallis tests. When reviewing the rank-order tables, recall that the rank-order scales used on the survey identified 1 as the most important/best performed item and 5 as least important/least adequately performed item. Therefore, when comparing the two numbers, a lower number reflects the more important/better performed item. When discussing these tables all references by the researchers to higher rankings or higher scores will refer to an items' higher importance or higher performance rather than to the size of the numeric score itself. All tables presenting Kruskal-Wallis test results display two comparative mean scores with the more important/better performed item in the left column.

For example, when comparing the TAC and SAC scores (157.85 and 186.01 respectively) on Information Availability from Table 9, the TAC score is the higher score because it indicates the item ranked as more important. Therefore, the researchers conclude that overall TAC respondents place more importance on the availability of information than did SAC respondents.

Nonparametric tests also revealed statistically significant differences between how respondents from the two commands rank ordered five of the twenty-nine customer service criteria. A summary of those findings appears in Table 10.

TABLE 10

DIFFERENCES IN **CRITERIA RANKINGS FOR PERFORMANCE** BY MAJCOM  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Criteria</u>	Kruskal-Wallis Mean Rank Sum (TAC / SAC)
<u>General Service</u>	
Takes appropriate action to resolve problem when they occur	154.81 / 192.38
<u>Information Availability</u>	
Minimizes effort to reach maintenance service personnel by telephone	157.49 / 181.11
Provides information on changes to maintenance policies	190.06 / 166.89
<u>Professionalism</u>	
Displays military bearing	163.80 / 186.98
<u>Vehicle Maintenance Timeliness</u>	
Minimizes vehicle turn-in time	161.77 / 184.25

Of the five areas identified as significantly different, respondents from former TAC bases ranked the performance of customer service elements higher than did customers from former SAC bases in four of the five cases. TAC respondents' higher performance rankings for many of the customer elements in Table 10 might indicate differences in the customer service emphasis by Vehicle Maintenance management at former TAC and SAC bases.

The researchers believe it is also meaningful that there were no significant differences for the importance rankings of the customer service criteria. Furthermore, respondents differed on the importance ranking of only one general attribute. In other words, no matter what the customers' prior MAJCOM affiliation, customers throughout ACC share a common understanding of what constitutes high quality service. The researchers believe this could be a reflection of the increased emphasis on Quality Air Force.

**H<sub>0</sub>2a: There are no significant differences between customers segmented by organization of assignment (CES, SPS, SUPS, TRV, Aircraft Maintenance) with regard to their identification of the importance of customer service elements.**

**H<sub>0</sub>2b: There are no significant differences between customers segmented by organization of assignment with regard to their identification of the performance of customer service elements.**

The researchers were interested in analyzing the differences in the responses for each organization. They suspected that any significant differences could provide Vehicle Maintenance managers with information that would allow them to focus their customer service efforts according to an organization's specific needs. Analysis did reveal statistically significant differences in how respondents from various organizations rank ordered the importance and/or performance of four of the five customer service attributes. Those differences are presented in Table 11.

TABLE 11

DIFFERENCES IN **ATTRIBUTE RANKINGS** BY ORGANIZATION  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Organizations</u>	<u>Kruskal-Wallis Mean Rank Sum</u>
General Service		
<b>Importance</b>	SPS - CES	154.85 / 214.01
	SUPS - CES	163.34 / 214.01
Professionalism of Vehicle Maintenance Personnel		
<b>Importance</b>	SPS - SUPS	157.38 / 200.34
	TRV - SUPS	152.96 / 200.34
<b>Performance</b>	A/C Maint - SPS	148.66 / 194.01
	A/C Maint - SUPS	148.66 / 193.86
	A/C Maint - TRV	148.66 / 196.42
Vehicle Maintenance Timeliness		
<b>Importance</b>	CES - TRV	155.17 / 232.62
	A/C Maint - TRV	156.79 / 232.62
	Other - TRV	169.51 / 232.62
<b>Performance</b>	Other - CES	136.21 / 189.49
	Other - A/C Maint	136.21 / 195.64
Vehicle Maintenance Quality		
<b>Performance</b>	SUPS - A/C Maint	158.63 / 215.35
	TRV - A/C Maint	143.63 / 215.35
<hr/>		
CES - Civil Engineering	TRV - Transportation Vehicle	
SPS - Security Police	Operations	
SUPS - Supply	A/C Maint - Aircraft Maintenance	
OTHER - Logistics/Operations Group Commanders and operational		
squadron commanders responsible for aircraft maintenance		

Of the differences presented in Table 11, the researchers noted two particular trends. First, Aircraft Maintenance personnel ranked Vehicle Maintenance's performance in the area of professionalism significantly higher than did Security Police, Supply, or Vehicle Operations personnel. Possible motivations behind this higher ranking are unclear and require further investigation.

Second, Vehicle Operations personnel ranked the importance of Vehicle Maintenance Timeliness significantly lower than did Civil Engineering, Aircraft Maintenance, or

"Other" personnel. This decreased emphasis on the importance of timeliness might be due, in part, to the fact that Vehicle Operations, by nature of its vehicle management responsibilities and general purpose fleet structure, generally has ready access to substitute vehicles when a vehicle goes in for maintenance. It may also be due to the fact that Vehicle Operations is part of the Transportation Squadron and therefore receives preferential treatment from Vehicle Maintenance. In either case, timeliness appears to be less of an issue for Vehicle Operations than it is for organizations with a few pieces of highly specialized equipment.

Examining organizational differences in the importance and performance rankings for the specific criteria pertaining to each attribute can provide further insight into which areas Vehicle Maintenance should focus its service efforts to better meet its customers' needs. Table 12 lists the organizational differences in the ranked criteria.

Before examining Table 12 in detail, several observations warrant discussion. First, note that not every attribute identified in Table 11 is listed in Table 12 (i.e. Professionalism of Vehicle Maintenance Personnel and Vehicle Maintenance Quality). This implies that while organizations may differ in their importance and/or performance rankings of these attributes, they generally do agree on the

importance and/or performance of the specific criteria associated with each attribute.

TABLE 12

### DIFFERENCES IN CRITERIA RANKINGS BY ORGANIZATION AT A .05 LEVEL OF SIGNIFICANCE

<u>Criteria</u>	<u>Organizations</u>	Kruskal-Wallis <u>Mean Rank Scores</u>
<u>General Service</u>		
Operates hours that accommodate my organization's work schedule Performance	CES - SPS	142.50 / 199.95
Works to accommodate my organization's special requirements Performance	A/C Maint - SUPS	167.12 / 217.75
	SPS - SUPS	156.27 / 217.75
	Other - SUPS	166.09 / 217.75
Provides after-hour maintenance support Importance	SPS - CES	132.16 / 186.05
	SPS - SUPS	132.16 / 199.97
	SPS - TRV	132.16 / 193.28
	SPS - Other	132.16 / 199.20
<u>Information Availability</u>		
Provides information on scheduled maintenance Importance	CES - Other	158.28 / 224.08
	SPS - Other	147.98 / 224.08
	SUPS - Other	170.20 / 224.08
	TRV - A/C Maint	147.98 / 203.04
Provides information on changes to repair completion times Importance	CES - SPS	156.65 / 211.70
<u>Vehicle Maintenance Timeliness</u>		
Minimizes vehicle turn-in time Performance	A/C Maint - SPS	154.38 / 211.22
	A/C Maint - Other	154.38 / 209.58
Meets estimated vehicle repair schedule Importance	Other - CES	127.68 / 195.02
	SUPS - A/C Maint	152.66 / 211.09
	Other - A/C Maint	127.68 / 211.09
Minimizes vehicle repair time Importance	CES - TRV	156.99 / 224.39
	SUPS - TRV	174.82 / 224.39
	Other - TRV	160.44 / 224.39
Performance	TRV - A/C Maint	150.30 / 206.33
Minimizes time to answer my questions Performance	CES - SUPS	155.26 / 206.18
	CES - TRV	155.26 / 220.78
	A/C Maint - TRV	164.66 / 220.78
<hr/> CES - Civil Engineering      TRV - Transportation Vehicle SPS - Security Police          Operations SUPS - Supply                A/C Maint - Aircraft Maintenance OTHER - Logistics/Operations Group Commanders and operational squadron commanders responsible for aircraft maintenance		

One should also note the appearance of organizational differences for the rankings of criteria related to Information Availability in Table 12, while this attribute does not appear in Table 11. This implies that while some organizations differed in their importance rankings for at least one criterion under Information Availability, customer organizations were generally in agreement on the importance and performance rankings of Information Availability with respect to the other customer service attributes.

Table 12 reflects many statistically significant organizational differences in importance and performance rankings for specific criteria. First, note that Security Police ranked the importance of after-hours maintenance support significantly higher than four other organizations. Such emphasis on after-hours maintenance support could be attributed to the Security Police's around-the-clock mission and should signal a possible area of concern for Vehicle Maintenance managers.

Next, note that Supply ranked the performance for "Works to accommodate my organization's special requirements" as significantly lower than three other customer groups. These differences indicate that while this criterion is as important to Supply as it is to other organizations, Supply personnel do not believe that Vehicle Maintenance performs as well in this area as do some other organizations. From this, one might infer that Vehicle Maintenance fails to provide its Supply customers with the

same level of support in this area as it does other customers.

The third area of interest concerns the significant differences in importance rankings for "Provides information on scheduled maintenance". The lower rankings assigned to this criterion by those customers comprising the "Other" category may be due to the fact that by nature of their positions, those individuals are somewhat removed from the immediate information loop and rely largely on secondary information passed on from their vehicle control officers.

Finally, note that Vehicle Operations ranked "Minimizes vehicle repair time" as significantly less important than did Civil Engineering, Supply, and "Other" customers. This supports earlier indications that Vehicle Maintenance Timeliness was significantly less important to Vehicle Operations than it was to other customer organizations.

Next, the researchers tested for organizational differences in the ordered metric importance and frequency ratings of the customer service attributes. Those differences are displayed in Table 13.

Because Kruskal-Wallis was also used to test for rating differences, all calculations were similar to those described earlier for rank-ordered differences. Therefore, all tables for rated differences are interpreted in the same manner as those for ranked differences, with one fundamental difference. Because importance and frequency ratings were assigned on a seven point ordered metric scale with 1 being

the least important/least frequently observed score and 7 being the most important/most frequently observed score, ratings with higher mean rank scores are more important/more frequently observed than ratings with lower mean rank scores. For example, Table 13 indicates Civil Engineering rated General Service frequency higher than did Aircraft Maintenance (mean rank sums were 188.75 and 136.27 respectively).

TABLE 13

DIFFERENCES IN **ATTRIBUTE RATINGS** BY ORGANIZATION  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Organizations</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>General Service</u>		
<b>Frequency</b>	CES - A/C Maint	188.75 / 136.27
	SUPS - A/C Maint	220.93 / 136.27
	TRV - A/C Maint	229.11 / 136.27
	Other - A/C Maint	189.95 / 136.27
<u>Information Availability</u>		
<b>Frequency</b>	SUPS - A/C Maint	227.53 / 176.49
	TRV - A/C Maint	232.78 / 176.49
	TRV - CES	232.78 / 179.50
	TRV - Other	232.78 / 180.45
<u>Vehicle Maintenance Timeliness</u>		
<b>Frequency</b>	SUPS - A/C Maint	240.76 / 186.53
	SUPS - CES	240.76 / 172.21
	TRV - CES	232.33 / 172.21
<u>Vehicle Maintenance Quality</u>		
<b>Frequency</b>	SUPS - CES	250.22 / 193.87
	SUPS - A/C Maint	250.22 / 194.15
	SUPS - Other	250.22 / 194.91
	TRV - CES	253.90 / 193.87
	TRV - A/C Maint	253.90 / 193.87
	TRV - Other	253.90 / 194.91
CES - Civil Engineering      TRV - Transportation Vehicle SPS - Security Police      Operations SUPS - Supply      A/C Maint - Aircraft Maintenance OTHER - Logistic/Operations Group commanders and operational squadron commanders responsible for aircraft maintenance		

A review of Table 13 reveals some interesting trends. Note that there were no statistically significant organizational differences in importance ratings for any of the attributes. As discussed earlier, the researchers suspected most respondents would rate all or most of the attributes as critically important (hence the subsequent request that customers rank order the attributes in order of their importance). While the researchers cannot conclude that all customers rated each attribute as critically important, this lack of differences in importance ratings from customer organizations does indicate that generally, all attributes are of equal importance to all the organizations surveyed.

Next, it is interesting to note that, for the frequency differences reflected in Table 13, Supply and Vehicle Operations generally rated Vehicle Maintenance higher (i.e., they observed the given attributes more often) than did Aircraft Maintenance and Civil Engineering. These differences may be due to the differences in the types of vehicles assigned to each organization. Vehicle Operations and Supply personnel usually operate general purpose vehicles, while Aircraft Maintenance and Civil Engineering personnel operate special purpose vehicles and equipment. Given the different vehicle types, one might infer that Vehicle Maintenance does not meet the needs of customers with special purpose equipment as frequently as it does for those customers with general purpose vehicles. This

possibility will be examined later in the discussion of importance, performance, and frequency differences according to vehicle type.

A quick review of Tables 11, 12, and 13 reveals a number of significant differences in the importance organizations place on the customer service attributes and criteria, and in their perceptions of Vehicle Maintenance's performance and frequency in providing those elements. The following section examines those same elements with respect to customer differences by vehicle fleet size.

**H<sub>3a</sub>: There are no significant differences between customers segmented according to vehicle fleet size of the respondent's organization (1-50, 51-100, 101-150, 151+) with regard to their identification of the importance of customer service elements.**

**H<sub>3b</sub>: There are no significant differences between customers segmented according to vehicle fleet size of the respondent's organization with regard to their identification of the performance of customer service elements.**

As with the other customer characteristics, the researchers believed analysis of the rank-ordered importance and performance of the customer service attributes according to respondents' vehicle fleet sizes might provide valuable insight for developing and customizing service strategies. Table 14 displays the statistically significant differences in how customers with various fleet sizes rank ordered the importance and performance of the customer service attributes.

TABLE 14

DIFFERENCES IN **ATTRIBUTE RANKINGS** BY FLEET SIZE  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Fleet Size</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
Professionalism of Vehicle Maintenance Personnel		
<b>Importance</b>	2 - 3	164.89 / 215.38
	4 - 3	149.00 / 215.38
Vehicle Maintenance Quality		
<b>Performance</b>	1 - 3	174.74 / 239.81
	2 - 3	195.51 / 239.81
	4 - 3	142.42 / 239.81
	4 - 2	142.42 / 195.51
1 - 1 to 50 vehicles	3 - 101 to 150 vehicles	
2 - 51 to 100 vehicles	4 - 151 or more vehicles	

As Table 14 indicates, there were very few variations in how respondents' with various fleet sizes ranked the importance or performance of the customer service attributes. Significant differences existed for only two of the ten ranked areas. This lack of variation is itself significant, as it indicates that Vehicle Maintenance Quality and Vehicle Maintenance Timeliness, ranked respectively as the first and second most important attributes by customers as a whole, are no more or less important to customers with large vehicle fleets than they are to those with relatively small fleets. However, of those differences reflected in Table 14, it is interesting to note that respondents with a fleet size of 101 to 150 vehicles ranked the performance factor of Vehicle Maintenance Quality significantly lower than did customers with other fleet sizes. This may indicate that while all

customers place nearly the same level of importance on Vehicle Maintenance Quality regardless of fleet size, those with 101 to 150 vehicles perceive Vehicle Maintenance's performance with respect to quality as significantly lower than do those with larger or smaller fleets. Consequently, Vehicle Maintenance may need to concentrate specifically on the quality of maintenance provided to customers with relatively large (101-150 vehicles) fleets.

Table 14 also indicates that customers with a fleet of 101 to 150 vehicles ranked the importance of "Professionalism of Vehicle Maintenance Personnel" significantly lower than did those with the next smallest and largest fleet sizes. The possible implications of this lower ranking are unclear to the researchers, but there is little reason to believe that they are related to the lower importance rankings for Vehicle Maintenance Quality.

The analysis for differences in importance and performance rankings of the specific criteria associated with each customer service attribute again revealed very few significant differences among respondents of varying fleet sizes. Table 15 summarizes those differences. The lack of variation in Table 15 is significant in that it also indicates that regardless of their fleet size, customers generally agree on the importance of customer service criteria and on Vehicle Maintenance's performance with respect to those criteria.

TABLE 15

DIFFERENCES IN **CRITERIA RANKINGS** BY FLEET SIZE  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Criteria</u>	<u>Fleet Size</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>Professionalism of Vehicle Maintenance Personnel</u>		
Displays concern for customers		
<b>Importance</b>	3 - 1	136.25 / 197.14
<u>Vehicle Maintenance Quality</u>		
Provides quality vehicle repairs		
<b>Importance</b>	2 - 3	166.33 / 224.21
	4 - 3	158.48 / 224.21
1 - 1 to 50 vehicles	3 - 101 to 150 vehicles	
2 - 51 to 100 vehicles	4 - 151 or more vehicles	

Tests for differences in the importance and frequency ratings of the customer service attributes revealed no significant differences according to customers' vehicle fleet sizes. This absence of variation indicates that, given a choice, customers rated the importance of all the attributes generally the same, regardless of fleet size. It also implies that the perceived frequency with which Vehicle Maintenance performs those attributes is basically the same.

Considering the relatively few differences in how customer groups with various fleet sizes evaluated the importance, performance, and frequency of the customer service elements, the researchers concluded that vehicle fleet size is not a major variable of concern in indentifying customer service requirements.

H<sub>4a</sub>: There are no significant differences between customers segmented by rank (Field Grade Officer, Company Grade Officer, Senior NCO, NCO, Airman) with regard to their identification of the importance of customer service elements.

H<sub>4b</sub>: There are no significant differences between customers segmented by rank with regard to their identification of the performance of customer service elements.

The researchers believed that significant differences in customer service importance and performance rankings among respondents of various ranks might further reflect the different perspectives from which customers evaluate the importance and performance of service elements. The statistically significant differences for importance and performance rankings according to respondents' rank are presented in Table 16.

TABLE 16

DIFFERENCES IN **ATTRIBUTE RANKINGS** BY RANK  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Rank</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
Professionalism of Vehicle Maintenance Personnel		
<b>Importance</b>	FGO - CGO	134.87 / 165.64
	FGO - NCO	134.87 / 184.23
Vehicle Maintenance Timeliness		
<b>Importance</b>	CGO - Airman	152.35 / 212.41
	SNCO - Airman	156.81 / 212.41
Vehicle Maintenance Quality		
<b>Importance</b>	FGO - Airman	132.68 / 193.38
<b>Performance</b>	FGO - CGO	135.41 / 179.96
	FGO - SNCO	135.41 / 177.77
	FGO - NCO	135.41 / 187.88
	FGO - Airman	135.41 / 170.04
<hr/>		
FGO - Field Grade Officer		SNCO - Senior NCO
CGO - Company Grade Officer		NCO - Noncommissioned Officer

Table 16 shows differences in three of the importance and performance customer service attributes. In general, for items identified as significantly different, managers (Field Grade Officers, Company Grade Officers, and Senior NCOs) ranked the items more important or better performed than did non-managers (NCOs and Airmen). Of particular interest were the significant differences identified for Vehicle Maintenance Timeliness and Vehicle Maintenance Quality. As discussed previously, these were the top two importance attributes for the entire sample (Table 5). For Vehicle Maintenance Timeliness, managers (Company Grade Officers and Senior NCOs) ranked the importance of the attribute significantly higher than did Airmen. This implies that while there is general agreement that Vehicle Maintenance Timeliness was the second most important attribute, there are significant differences between the various ranks concerning just how important it really is. Since managers are typically the officers and senior noncommissioned officers-in-charge of flights, they are very interested in any factors that directly affect their operations. The high ranking by managers in the area of Vehicle Maintenance Timeliness suggests that these managers understand the potential impact Vehicle Maintenance has on their missions. Therefore, they place more value on the timeliness of maintenance service than Airmen who may not see the overall effect of long term maintenance.

For Vehicle Maintenance Quality, Field Grade Officers ranked Vehicle Maintenance's performance higher than any other group and ranked its importance higher than did Airmen. There are a number of possible reasons for these differences. Within the respondent group, Field Grade Officers were organizational or group commanders. Such commanders generally experience very little direct interaction with Vehicle Maintenance and consequently must rely on their Vehicle Control personnel or prepared reports to identify problems. Therefore, it is unlikely that commanders are aware of any day-to-day maintenance problems within their vehicle fleets unless they impact the mission. Problems of this nature are the exception rather than the norm and it is likely that Field Grade Officers interpret this lack of problems as "good quality". Field Grade Officers also ranked the importance of Vehicle Maintenance Quality higher than Airmen. Again, this implies that the Field Grade Officers understand the critical importance of maintenance to their mission effectiveness. Conversely, Airmen and NCOs ranked Vehicle Maintenance Quality significantly lower on the performance and importance scales than did managers. The researchers suspect that the Airmen and NCO respondents had regular interaction with Vehicle Maintenance in their positions as Vehicle Control Officers/NCOs. In these positions, they were likely to experience more inconsistencies in the quality of the maintenance performed by Vehicle Maintenance than did their

managers. Thus, people who have direct interaction with Vehicle Maintenance are less satisfied with the quality of maintenance than managers who do not directly interact with Vehicle Maintenance.

To further investigate the differences in the importance and performance rankings, the researchers analyzed the criteria for each attribute by respondents' rank. Table 17 presents the significant differences for the criteria by rank.

TABLE 17  
DIFFERENCES IN CRITERIA RANKINGS BY RANK  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Criteria</u>	<u>Ranks</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>General Service</u>		
Provides after-hour maintenance support		
<b>Importance</b>	Airman - FGO	149.63 / 202.32
Provides training programs to suit my organization's needs		
<b>Importance</b>	Airman - FGO	128.02 / 174.22
	Airman - CGO	128.02 / 179.00
	Airman - NCO	128.02 / 190.28
<b>Frequency</b>	CGO - SNCO	131.18 / 194.13
<u>Information Availability</u>		
Provides information on projected vehicle repair completion times		
<b>Importance</b>	FGO - Airman	160.73 / 238.74
	CGO - Airman	155.94 / 238.74
	SNCO - Airman	172.91 / 238.74
	NCO - Airman	177.59 / 238.74
Provides information on changes to projected repair completion times		
<b>Importance</b>	FGO - Airman	178.86 / 234.86
	CGO - Airman	152.44 / 234.86
	SNCO - Airman	167.04 / 234.86
	NCO - Airman	174.89 / 234.86
<b>Frequency</b>	FGO - CGO	144.60 / 197.64
<div style="display: flex; justify-content: space-between;"> <span>FGO - Field Grade Officer</span> <span>SNCO - Senior NCO</span> </div> <div style="display: flex; justify-content: space-between;"> <span>CGO - Company Grade Officer</span> <span>NCO - Noncommissioned Officer</span> </div>		

TABLE 17 (CONTINUED)

<u>Criteria</u>	<u>Ranks</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>Information Availability</u>		
Minimizes the effort to reach maintenance service personnel by telephone		
<b>Frequency</b>	CGO - FGO	143.59 / 200.62
	Airman - FGO	144.03 / 200.62
Provides information on changes to maintenance policies		
<b>Importance</b>	Airman - CGO	129.97 / 195.03
	Airman - NCO	129.97 / 184.41
<u>Professionalism of Vehicle Maintenance Personnel</u>		
Displays courtesy		
<b>Importance</b>	Airman - FGO	141.52 / 203.94
	Airman - CGO	141.52 / 194.85
<u>Vehicle Maintenance Timeliness</u>		
Meets estimated vehicle repair schedule		
<b>Frequency</b>	FGO - Airman	141.96 / 205.52
Minimizes vehicle repair time		
<b>Frequency</b>	FGO - CGO	139.61 / 196.63
	Airman - CGO	137.26 / 196.63
<u>Vehicle Maintenance Quality</u>		
Provides quality vehicle repairs		
<b>Importance</b>	SNCO - Airman	157.95 / 209.48
<hr/> FGO - Field Grade Officer      SNCO - Senior NCO CGO - Company Grade Officer      NCO - Noncommissioned Officer		

As Table 17 shows, customers differed in their importance and/or performance rankings of at least one criterion under each customer service attribute. In analyzing the data, the researchers again identified a trend in the rankings by managers and non-managers. In general, managers ranked areas that directly related to management functions (i.e., "Provides information on projected vehicle repair completion times" and "Provides information on changes to projected repair completion times") as more important or better performed than did Airmen. Conversely, Airmen were more interested in interactive activities and

ranked those criteria as more important. Specifically, Airmen ranked "Provides training programs to suit my organization's needs", "Provides information on changes to maintenance policies", and "Displays courtesy" as more important than did other groups. These trends provide further support for the conclusion that people are most interested in the areas that directly involve them (i.e., managers and supervisors are most interested in management information while Airmen are most interested in the direct interaction activities).

Significantly, these findings could imply that different members within a single organization have different ideas about what is important to them. The researchers believe this has serious ramifications for Vehicle Maintenance managers who are trying to determine their customers' needs and then meet those needs. As discussed in Chapter II, one of the keys to designing a customer service strategy is determining what customers want. If members within an organization do not agree on what customer service is, then Vehicle Maintenance will not be able to establish a customer service strategy to support that organization and will probably never be able to really improve customer service. This suggests that an organization needs to build a consensus as to what it, the customer, considers important.

The last step in analyzing the differences between the groups was to evaluate the importance and frequency ratings

of the attributes. The results of this analysis are presented in Table 18.

TABLE 18  
DIFFERENCES IN **ATTRIBUTE RATINGS** BY RANK  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Ranks</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>General Service</u>		
<b>Importance</b>	FGO - Airman	214.28 / 145.69
	CGO - Airman	230.99 / 145.69
	SNCO - Airman	217.33 / 145.69
<b>Frequency</b>	FGO - CGO	213.63 / 154.87
	FGO - NCO	213.63 / 161.79
	FGO - Airman	213.63 / 134.87
	SNCO - Airman	192.00 / 134.87
<u>Information Availability</u>		
<b>Frequency</b>	FGO - Airman	218.51 / 138.17
	CGO - Airman	193.19 / 138.17
	SNCO - Airman	200.52 / 138.17
<u>Professionalism of Vehicle Maintenance Personnel</u>		
<b>Importance</b>	FGO - NCO	244.95 / 190.48
	FGO - Airman	244.95 / 178.78
<b>Frequency</b>	FGO - Airman	224.63 / 151.57
	SNCO - Airman	221.85 / 151.57
<hr/> FGO - Field Grade Officer                      SNCO - Senior NCO CGO - Company Grade Officer                      NCO - Noncommissioned Officer		

Again the researchers identified significant trends for management and non-management groups. In all areas identified as statistically significantly different, managers generally rated the items as more important or more frequently observed than did Airmen. Under General Service and Professionalism of Vehicle Maintenance Personnel, Airmen rated both importance and frequency lower than did managers. The researchers concluded that this is also due to the

respondents' level of involvement (direct or indirect) with Vehicle Maintenance. Lower ratings in importance and frequency in both these areas implies that Airmen do not perceive General Service or Professionalism to be as important as respondents of other ranks. These findings contradict the analysis from the last section where Airmen ranked the importance of two General Service criteria and one Professionalism criterion significantly higher than did managers. The researchers can draw no conclusions from these disparities. Further research is necessary in this area.

Analysis also indicated that Airmen rated the frequency of Information Availability lower than managers. The researchers believe this is again due to the level of respondents' involvement. Airmen deal with Vehicle Maintenance on a regular basis and are more likely to deal with changing information. Managers, on the other hand, deal only with the information provided to them by their Vehicle Control Personnel or written reports and such information is likely to be static and accurate by the time it reaches them. Again, this implies that managers are more interested in management information and that non-managers are interested in the more direct interaction activities.

In short, managers and Airmen do not agree on the importance and/or the observed frequency of the three attributes in Table 18. These ratings further support the researchers' earlier statement that members within an

organization have different ideas about what services they consider important. And as stated earlier, members within an organization must have a general consensus about the service expected from Vehicle Maintenance. Until customers (organizations) agree on and identify their requirements, Vehicle Maintenance cannot effectively meet their needs.

**H<sub>5a</sub>: There are no significant differences between customers segmented according to the type/class vehicle operated (general purpose, refueling, firefighting, materials handling, LE sedans, flightline tow, other special purpose) with regard to their identification of the importance of customer service elements.**

**H<sub>5b</sub>: There are no significant differences between customers segmented according to the type/class vehicle operated with regard to their identification of the performance of customer service elements.**

The researchers suspected that significant differences would exist in how operators of different types of vehicles ranked ordered the importance and performance of customer service attributes. Like organizational differences, variation according to the type of vehicle operated could be a reflection of the respondents' differing missions. Because vehicle type and organization are closely related variables, the researchers suspected that differences according to vehicle type would be similar to the organizational differences identified earlier. Table 19 displays the results of the analysis by vehicle type.

TABLE 19

DIFFERENCES IN **CRITERIA RANKINGS** BY TYPE/CLASS VEHICLE  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Criteria</u>	<u>Type</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>General Service</u>		
Provides after-hour maintenance support		
<b>Importance</b>	5 - 1	110.65 / 184.61
	5 - 2	110.65 / 166.96
	5 - 4	110.65 / 201.18
	5 - 6	110.65 / 201.21
	5 - 7	110.65 / 172.63
<u>Professionalism of Vehicle Maintenance Personnel</u>		
Displays courtesy		
<b>Importance</b>	1 - 2	175.06 / 256.93
	3 - 2	177.72 / 256.93
	4 - 2	201.59 / 256.93
	5 - 2	197.20 / 256.93
	7 - 2	166.54 / 256.93
	6 - 2	117.32 / 256.93
	6 - 1	117.32 / 175.06
	6 - 3	117.32 / 177.72
	6 - 4	117.32 / 201.59
	6 - 5	117.32 / 197.20
<u>Vehicle Maintenance Quality</u>		
Fixes only customer identified vehicle discrepancies each visit		
<b>Performance</b>	4 - 1	110.06 / 175.75
	4 - 2	110.06 / 198.50
	4 - 3	110.06 / 180.15
	4 - 6	110.06 / 192.55
	4 - 5	110.06 / 198.80
	7 - 5	145.06 / 198.80
	7 - 2	145.06 / 198.50
Performs reliable maintenance		
<b>Performance</b>	1 - 4	166.63 / 248.94
	2 - 4	151.76 / 248.94
	3 - 4	168.72 / 248.94
	5 - 4	139.05 / 248.94
	6 - 4	194.39 / 248.94
	1 - 7	166.63 / 217.59
	2 - 7	151.76 / 217.59
	5 - 7	139.05 / 217.59
	5 - 6	139.05 / 194.39
<div style="display: flex; justify-content: space-between;"> <div> 1 - General Purpose  2 - Refueling  3 - Firefighting  4 - Materials Handling  * Primarily includes CES special purpose equipment </div> <div> 5 - Law Enforcement Sedan  6 - Flightline Tow  *7 - Other Special Purpose </div> </div>		

Surprisingly, analysis according to vehicle type revealed no significant differences in the rank-ordered

importance or performance of the more general customer service attributes, indicating that customers generally ranked the attributes similarly in both importance and performance, regardless of the type vehicle they were responsible for. However, analysis did reveal statistically significant differences in how customers ranked the importance and/or performance of certain criteria under three of the five service attributes.

The researchers identified several trends in the differences in rankings by vehicle type. First note that customers operating law enforcement sedans ranked the importance of "Provides after-hour maintenance personnel" significantly higher than did all other respondent groups except firefighters. Considering that only Security Police personnel operate these sedans, this higher ranking corresponds to earlier data indicating that the Security Police ranked this item significantly higher than did all other organizations (Table 12). This evidence further supports the idea that perhaps Vehicle Maintenance should adjust its service strategy to accommodate the Security Police's around-the-clock mission. The fact that the Security Police and firefighters did not differ on the importance of this item is also significant, indicating that emergency response vehicles in general require twenty-four hour maintenance support. Again, adjustments in Vehicle Maintenance service strategies may be required to support these customers' needs.

It is also important to note the differences in performance rankings for "Fixes only customer identified vehicle discrepancies each visit". Materials handling equipment operators (primarily Supply personnel) ranked this item significantly higher than did all other vehicle type operators, with the exception of those personnel in the "Other Special Purpose" category. Next, the researchers noted that materials handling equipment operators ranked the performance criterion of "Performs reliable maintenance" significantly lower than did all other vehicle type operators (again with the exception of those personnel in the "Other Special Purpose" category). A comparison of the high and low rankings for these two criteria could indicate that while materials handling equipment operators like the Vehicle Maintenance practice of fixing only customer identified vehicle discrepancies each visit (as opposed to fixing additional discrepancies identified by Vehicle Maintenance personnel), they perceive the reliability of the maintenance as being poor. The researchers note that while fixing only customer identified discrepancies is intended to reduce vehicle downtime, poor maintenance reliability generally means increased vehicle downtime in the long run. The rankings might suggest that Vehicle Maintenance managers need to focus more on the quality of vehicle repairs and less on short-term vehicle downtime.

In addition to the differences in importance and performance rankings of customer service criteria, analysis

also indicated statistically significant differences in the importance and frequency ordered metric ratings for two of the five customer service attributes. Table 20 summarizes those differences.

TABLE 20

DIFFERENCES IN ATTRIBUTE RATINGS BY TYPE/CLASS VEHICLE  
AT A .05 LEVEL OF SIGNIFICANCE

<u>Attribute</u>	<u>Vehicle Types</u>	<u>Kruskal-Wallis Mean Rank Sums</u>
<u>General Service</u>		
<b>Importance</b>	3 - 1	287.20 / 204.92
	3 - 2	287.20 / 208.46
	3 - 4	287.20 / 176.43
	3 - 6	287.20 / 173.80
	3 - 7	287.20 / 187.90
	5 - 1	258.15 / 204.92
	5 - 2	258.15 / 208.46
	5 - 4	258.15 / 176.43
	5 - 6	258.15 / 173.80
	5 - 7	258.15 / 187.90
<b>Frequency</b>	2 - 1	235.42 / 177.13
	2 - 4	235.42 / 167.40
	2 - 6	235.42 / 138.09
	2 - 7	235.42 / 167.06
	3 - 6	209.00 / 138.09
	5 - 1	233.33 / 177.13
	5 - 7	233.33 / 167.06
<u>Professionalism of Vehicle Maintenance Personnel</u>		
<b>Importance</b>	1 - 2	217.68 / 160.67
	3 - 2	264.28 / 160.67
	3 - 4	264.28 / 186.23
	3 - 6	264.28 / 174.70
	3 - 7	264.28 / 201.38
	5 - 2	259.89 / 160.67
	5 - 4	259.89 / 186.23
	5 - 6	259.89 / 174.70
	5 - 7	259.89 / 201.38
<b>Frequency</b>	1 - 7	213.11 / 152.12
	2 - 4	236.63 / 177.63
	2 - 6	236.63 / 183.55
	2 - 7	236.63 / 152.12
	5 - 3	250.00 / 199.89
	5 - 4	250.00 / 177.63
	5 - 6	250.00 / 183.55
	5 - 7	250.00 / 152.12
<div> <div>1 - General Purpose</div> <div>2 - Refueling</div> <div>3 - Firefighting</div> <div>4 - Materials Handling</div> <div>* Primarily incudes CES special purpose equipment</div> </div> <div> <div>5 - Law Enforcement Sedan</div> <div>6 - Flightline Tow</div> <div>*7 - Other Special Purpose</div> </div>		

In reviewing the table, a number of trends are apparent. First, note that both firefighters and law enforcement personnel rated the importance of General Service significantly higher than did most other vehicle operators. These ratings reinforce the previous suggestion that the greater importance placed on General Service might be attributed to the twenty-four hour missions of emergency response type vehicles (Table 19 analysis).

The researchers next noted that refueling vehicle operators rated the frequency of General Service higher than did all other vehicle operators except law enforcement and firefighting personnel. This higher rating might be due, in part, to the fact that Vehicle Maintenance is structured to provide dedicated refueling maintenance support. As such, refueling vehicle operators work closely and interface regularly with dedicated refueling vehicle mechanics. Additionally, refueling vehicles often operate on a twenty-four hour schedule. The fact that refueling vehicle operators did not significantly differ from law enforcement and firefighting personnel in rating General Service frequency may also be important, possibly reflecting the higher emphasis Vehicle Maintenance places on servicing priority (emergency response) and direct mission support vehicles. However, earlier low General Service performance rankings from Security Police personnel could indicate that the priority maintenance program does not adequately or

equitably meet the needs of those it is designed to support.

Additionally, Table 20 reveals significant differences in importance and frequency ratings for Professionalism of Vehicle Maintenance Personnel. Again, this item is rated significantly higher by customers responsible for emergency response vehicles.

In total, the differences in importance, performance, and frequency scores for the attributes and criteria discussed above indicate that Vehicle Maintenance varies in the consistency of service it provides to different customer groups. From a management perspective, some variation can be expected as vehicle and mission priorities shift. However, such variation is unacceptable to the customer whose first priority is the service provider's last. This research indicates that Vehicle Maintenance should increase its efforts to meet all customers needs, regardless of vehicle type.

### Synopsis

Differences for the rank-ordered and rated customer service attributes and their associated criteria were presented above for each pair of hypotheses. The researchers found general disagreement among customer groups (particularly by prior command, organization, rank, and vehicle type) concerning the importance, performance, and observed frequency of the customer service attributes and

criteria. Analysis of customer groups also indicated that the majority of differences could be related to the customers' organizations. For example, vehicle type could be directly linked to specific organizations. Similarly, minor differences by fleet size could also be tied to organizations. Even the analysis of data by the respondents' ranks indicated a requirement for an organizational focus--a single set of service expectations understood by all members of an organization. In conclusion, the majority of analysis supports an organizationally focused customer service strategy.

#### Additional Comments

A brief review of the respondents' additional comments supports the findings of the nonparametric and parametric analysis. Of the 458 usable surveys returned, 234 customers provided written comments concerning Vehicle Maintenance customer service issues. The most commonly recurring themes included vehicle maintenance timeliness and quality, information availability, and professionalism.

Approximately sixty percent of the customers provided negative comments concerning 1) information on estimated vehicle repair times, 2) vehicles down for parts, 3) repeat maintenance requirements, 4) attitudes of customer service personnel, and 5) a perceived lack of customer support. Conversely, approximately forty percent of the customers commented positively on the attitudes of Vehicle Maintenance

personnel, including comments on their willingness and ability to help solve problems. These comments indicate that Vehicle Maintenance is taking positive steps toward improving customer service. However, Vehicle Maintenance must expand its focus to include not only a willingness to help, but a genuine understanding of customer requirements, followed by action to satisfy those requirements.

### Conclusion

This chapter presented the results of the data analysis described in Chapter III. Survey response rate was examined, followed by a review of the survey instrument's reliability. Answers to the researchers' investigative questions and results for the tests of hypotheses were then discussed. Comparisons of scores for importance and performance rankings and frequency ratings of customer service attributes and their associated criteria indicated that customer groups differed in the customer service elements they deemed important. Customer groups also differed in how they perceived Vehicle Maintenance's performance with respect to those elements. Finally, a brief summary of customers' additional comments was presented. Chapter V will expand on the conclusions presented here and will discuss their implications for Vehicle Maintenance management and performance measures.

## V. Conclusions and Recommendations

As stated in Chapter I, the objective of this research was to recommend a more comprehensive set of Vehicle Maintenance performance measures that integrate the ideas of product quality and customer service to provide an overall measure of service quality. Based on that objective, the specific objectives of the research were to 1) identify the customer service elements important to base transportation Vehicle Maintenance customers, 2) identify customer perceptions about how Vehicle Maintenance organizations meet those elements, 3) compare the customer service perceptions of different customer groups (by prior MAJCOM, organization, fleet size, rank, and vehicle type operated), and 4) recommend a set of customer oriented Vehicle Maintenance performance measures based on the findings in objectives 1 through 3.

This chapter first addresses the specific research objectives based on the findings in Chapter IV. Next, the researchers discuss additional recommendations based on those findings.

### Specific Objectives

#### Specific Objective 1

Identify the customer service elements important to base transportation Vehicle Maintenance customers.

To answer this question, the researchers analyzed the rank-ordered responses for the importance of the customer service attributes (General Service, Information Availability, Professionalism of Vehicle Maintenance Personnel, Vehicle Maintenance Timeliness, and Vehicle Maintenance Quality) and their associated criteria. Results of the rank-ordered importance for these elements are presented in Table 21. The table is structured to present the attributes in order of importance with 1 being the most important and 5 being the least important. Additionally, the top two criteria for each attribute are listed.

TABLE 21

IMPORTANCE RANKINGS FOR CUSTOMER SERVICE CRITERIA

<u>Item</u>	<u>Order of Importance</u>
<u>Vehicle Maintenance Quality</u>	1
Provides quality vehicle repairs	1
Fixes vehicle discrepancies the first time	2
<u>Vehicle Maintenance Timeliness</u>	2
Minimizes vehicle repair time	1
Minimizes total vehicle maintenance processing time	2
<u>General Service</u>	3
Takes action to resolve problems when they occur	1
Consistently meets my organization's service needs	2
<u>Professionalism of Vehicle Maintenance Personnel</u>	4
Displays a willingness to help	1
Displays concern for customers	2
<u>Information Availability</u>	5
Provides information on projected vehicle repair times	1
Provides information on scheduled maintenance	2

Table 21 presents a rank-ordered listing of the customer service attributes (and their associated criteria) that Vehicle Maintenance customers identified as important. A review of the researchers' findings indicates that the elements most important to ACC customers were Vehicle Maintenance Quality and Vehicle Maintenance Timeliness. Close evaluation of all the top ranked criteria reveals that, not surprisingly, customers gave high rankings to the criteria that had the most potential to directly impact them and/or their missions. For example, under Vehicle Maintenance Quality, "Provides quality maintenance repairs" and "Fixes vehicle discrepancies the first time" were the top two criteria. These criteria directly impact customers because poor maintenance quality or failing to properly repair a vehicle the first time would result in repeated trips to the Vehicle Maintenance facility. This process would expend valuable manhours and result in the loss of the vehicle for longer than necessary. For organizations relying on vehicles to perform their missions, this process would deplete necessary resources and reduce mission effectiveness.

The findings presented in Table 21 closely parallel those of the industry studies reviewed in Chapter II. Specifically, the research done by Bowersox and others' points out that customers want quality products and quality service. Furthermore, participants in Byrne's 1989 study for The Council of Logistics Management identified product

quality and timeliness of delivery as key factors in customer service. Therefore, the researchers conclude that to satisfy their customers, Vehicle Maintenance providers, like their commercial counterparts, must focus on product and service quality.

**Specific Objective 2**

Identify customer perceptions about how Vehicle Maintenance organizations meet those elements identified as important.

Tables 22 and 23 recap the comparisons of importance and performance rankings assigned to the customer service attributes and their criteria by Vehicle Maintenance customers.

**TABLE 22**

**IMPORTANCE AND PERFORMANCE RANKINGS FOR  
CUSTOMER SERVICE ATTRIBUTES**

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>
Vehicle Maintenance Quality	1	2
Vehicle Maintenance Timeliness	2	5
General Service	3	1
Professionalism of Vehicle Maintenance Personnel	4	3
Information Availability	5	4

Note - All importance and performance rankings were significantly different at  $\alpha=.05$

Comparing the results of the tests for differences in the rank-ordered importance and performance of the attributes, the researchers noted several differences. Although Vehicle Maintenance Quality and Vehicle Maintenance

Timeliness were ranked as the two most important attributes, they were only ranked second and fifth respectively on the performance scale. This implies that Vehicle Maintenance customers want both high quality and timely service but that they perceive they are not receiving timely service.

The attribute ranked as best performed (General Service) was ranked third on the importance scale. A review of the specific General Service criteria reveals that all these criteria evaluate areas involving direct interaction with customers and Vehicle Maintenance's responsiveness to the customers' specific needs. The researchers concluded that a high performance ranking in this area possibly indicated the recent Air Force and ACC emphasis on quality is having a positive affect on the personal interaction skills of Vehicle Maintenance personnel. However, its ranking as only the third most important attribute indicates that Vehicle Maintenance must concentrate more of its quality efforts on the items customers ranked as most important (Vehicle Maintenance Quality and Vehicle Maintenance Timeliness).

Analysis of the performance scores revealed that, on the average, customers did not rank any specific items as being particularly well or particularly poorly performed. Rather, the analysis indicates that Vehicle Maintenance's performance for all the attributes varies only slightly, and that customers perceive Vehicle Maintenance's overall performance as average.

A comparison of the specific importance and performance criteria also revealed several differences. As shown in Table 23, the top two criteria in all areas showed statistically significant differences in the importance and performance rankings. This clearly displays a difference between what the customers want and what they think they are getting.

TABLE 23

IMPORTANCE AND PERFORMANCE RANKINGS FOR  
CUSTOMER SERVICE CRITERIA

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>
<u>Vehicle Maintenance Quality</u>		
Provides quality vehicle repairs	1	1
Fixes vehicle discrepancies the first time	2	4
<u>Vehicle Maintenance Timeliness</u>		
Minimizes vehicle repair time	1	5
Minimizes total vehicle maintenance processing time	2	4
<u>General Service</u>		
Takes appropriate action to resolve problems when they occur	1	1
Consistently meets my organization's service needs	2	4
<u>Professionalism of Vehicle Maintenance Personnel</u>		
Displays a willingness to help	1	3
Displays concern for customers	2	4
<u>Information Availability</u>		
Provides information on projected vehicle repair completion times	1	2
Provides information on scheduled maintenance	2	1

Note - All importance and performance rankings were significantly different at  $\alpha=.05$

In summary, the researchers concluded that the customers do not yet perceive that Vehicle Maintenance is meeting their needs in the areas they deem important. While Vehicle Maintenance is meeting some of the customers' needs (i.e. General Service), the significant discrepancies between the importance and performance rankings indicate that Vehicle Maintenance must concentrate its service efforts on improving the quality and timeliness items customers ranked as most important. The research also indicated that while customers demonstrated clear preferences in the areas important to them, there were no clear indications that customers perceived Vehicle Maintenance as performing exceptionally well or poorly in any one area.

#### Specific Objective 3

Compare the customer service perceptions of different customer groups (by prior MAJCOM, organization, fleet size, rank, and type of vehicle).

Analysis of customer responses indicated a general disagreement among all customer groups concerning 1) the importance of customer service elements, 2) Vehicle Maintenance's performance with respect to those elements, and 3) the observed frequency of the elements. A summary of those findings is presented below.

By Prior Command. Test results revealed that customers from prior TAC bases ranked the performance of

Professionalism of Vehicle Maintenance Personnel and the importance of Information Availability higher than customers from prior SAC bases. Additionally, respondents differed in their rank orders of five of the twenty-nine specific criteria studied, with prior TAC personnel ranking the performance of four of those five criteria higher than their SAC counterparts. These higher performance rankings might indicate differences in the customer service emphasis by Vehicle Maintenance management at former TAC and SAC bases. Respondents' importance and frequency ratings of the general service attributes revealed no significant differences. The researchers believe it is important to note that overall, the any significant differences were primarily in performance rankings.

The absence of differences in how respondents from the two commands viewed the importance of the specific service criteria as well as four of the five general service attributes indicates that no matter what the customers' prior MAJCOM affiliation, customers throughout ACC share a common understanding of what constitutes high quality service. The researchers believe this could be a reflection of the increased emphasis on Quality Air Force.

By Organization. The analysis by customer organizations revealed statistically significant differences in how organizations rank-ordered the importance and/or performance of four of the customer service attributes. From those differences, the researchers identified two

trends. First, Aircraft Maintenance personnel ranked the performance aspect of Professionalism of Vehicle Maintenance Personnel significantly higher than did Security Police, Supply, or Vehicle Operations personnel. Possible reasons for this higher ranking are unclear and require further investigation. Second, Vehicle Operations personnel ranked the importance of Vehicle Maintenance Timeliness lower than did Civil Engineering, Aircraft Maintenance, or "Other" personnel. This decreased emphasis on the importance of timeliness may be attributed Vehicle Operations' immediate access to substitute vehicles when a vehicle goes in for maintenance or the possibility that Vehicle Operations receives preferential treatment as part of the Transportation Squadron. This idea is further supported by Vehicle Operations' lower importance ranking for the criterion "Minimizes vehicle repair time". In short, it appears that timeliness is less of an issue for Vehicle Operations than it is for organizations with a few pieces of highly specialized equipment.

Analysis also revealed statistically significant differences in the importance and/or performance rankings of the specific criteria pertaining to three of the five customer service attributes. Of those differences, the researchers noted that Security Police ranked the importance of after-hours maintenance support significantly higher than did four other organizations. Emphasis by the Security Police on after-hours maintenance support might be

attributed to its around-the-clock mission and should be an area of interest to Vehicle Maintenance managers.

Next, Supply's relatively low performance ranking of Vehicle Maintenance's responsiveness to its special requirements indicated that while this criterion was as important to Supply as it was to other organizations, Supply personnel did not believe Vehicle Maintenance performed as well in this area as did some other organizations. From this, one might infer that Vehicle Maintenance fails to provide its Supply customers with the same level of support in this area as it does other customers.

The next set of differences concerned significantly lower importance rankings for information on scheduled maintenance by those customers in the "Other" category. These lower rankings may be due to the fact that by nature of their positions (Logistics and Operations Group commanders and operational squadron commanders), commanders are somewhat removed from day-to-day interactions with Vehicle Maintenance and must rely on secondary information passed on from their Vehicle Control Officers.

The researchers also tested for organizational differences in the importance and frequency ratings of the customer service attributes. Results revealed no organizational differences in importance ratings for any of the attributes. This confirmed the researchers' idea that if given the choice, most respondents would rate all or most of the attributes as equally important. However, results

did reveal statistically significant differences in the frequency ratings for four of the five attributes. Findings indicated that generally, Supply and Vehicle Operations rated Vehicle Maintenance higher (i.e. they observed the given attributes more often) than did Aircraft Maintenance and Civil Engineering. In evaluating the key differences between the organizations, the researchers noted that Vehicle Operations and Supply personnel usually operate general purpose vehicles, while Aircraft Maintenance and Civil Engineering personnel operate special purpose vehicles and equipment. Given the different vehicle types assigned to these organizations, one might infer that Vehicle Maintenance does not meet the needs of customers with special purpose equipment as frequently as it does for those customers with general purpose vehicles.

By Fleet Size. Analysis indicated very few statistically significant differences in how customers with various fleet sizes rank ordered the importance and/or performance of two of the five customer service attributes. This lack of variation is significant itself, indicating that Vehicle Maintenance Quality and Vehicle Maintenance Timeliness, ranked as the first and second most important attributes by customers as a whole, are no more or less important to customers with large vehicle fleets than they are to those with relatively small fleets. However, the researchers did note that respondents with a fleet size of 101 to 150 vehicles ranked the performance factor of Vehicle

Maintenance Quality significantly lower than did customers with other fleet sizes. While all customers place nearly the same level of importance on Vehicle Maintenance Quality regardless of fleet size, this may indicate that those with 101 to 150 vehicles perceive Vehicle Maintenance's quality as poorer than do those with larger or smaller fleets. Consequently, Vehicle Maintenance may need to concentrate specifically on the quality of maintenance provided to these customers.

There were also very few significant differences in respondents' importance and performance rankings of the specific criteria associated with each attribute. This again supports the idea that regardless of fleet size, customers generally agree on the importance of customer service criteria and on Vehicle Maintenance's performance with respect to those criteria.

The researchers found no differences in the importance and frequency ratings of the customer service attributes according to vehicle fleet size. This absence of variation indicates that customers generally rated all the attributes as being of equal importance. It also implies that the perceived frequency with which Vehicle Maintenance performs those attributes is basically the same.

Considering the relatively few differences indicated by tests according to vehicle fleet size, the researchers concluded that fleet size is not a major variable of concern in satisfying customer service requirements.

By Military Rank. The researchers found that there were statistically significant differences in how respondents of various military ranks rank ordered the importance and/or performance of three of the five customer service attributes. In general, those personnel in management positions ranked Professionalism of Vehicle Maintenance Personnel, Vehicle Maintenance Timeliness and Vehicle Maintenance Quality as more important or better performed than did non-managers. Of particular interest were the differences in rankings for timeliness and quality. As discussed previously, these were identified as the two most important attributes by the entire sample. However, the differences in rankings here indicate that while there was general agreement on the importance of these attributes across the entire sample, there was significant disagreement between various ranks concerning the importance placed on quality and timeliness.

One implication of these findings is that management personnel have a better understanding of the potential impact Vehicle Maintenance activities have on their missions. The differences also indicate that managers are more interested in those factors directly affecting their operations (i.e. timeliness and quality) than are non-managers. The findings may also reflect the fact that managers are generally removed from direct interaction with Vehicle Maintenance personnel. Maintenance issues concerning an organization's vehicle fleet are generally

elevated to the management level only when problems might immediately and adversely impact that organization's mission. Because such occurrences are the exception rather than the norm, it is likely that managers interpret this lack of problems as "good quality".

Tests for differences in the importance and performance rankings of specific criteria associated with each attribute also revealed significant differences in the rankings of at least one criterion under each attribute. Again, the researchers found a general trend indicating that managers ranked areas directly related to management functions--managing information and resources--as more important or better performed than did non-managers. Conversely, non-managers, and particularly Airmen, were more interested in interactive activities and ranked those criteria as more important.

Similar differences in the importance and frequency ratings of the general service attributes provide additional support for the varying perspectives of management and non-management personnel. While the analysis generally supports the idea that people are most interested in the areas that directly involve them, it could also imply that different members within a single organization have different ideas concerning what service elements are most important. This possible disagreement among members of an organization has serious ramifications for Vehicle Maintenance managers trying to determine and meet their customers' needs. If

members within an organization do not agree on what customer service is, Vehicle Maintenance cannot effectively meet their needs and will never really be able to improve customer service.

By Type/Class Vehicle. Analysis according to vehicle type revealed no statistically significant differences in the rank-ordered importance or performance of the general customer service attributes, indicating that customers generally evaluated the attributes similarly. However, analysis did identify significant differences in how customers ranked the importance or performance of certain criteria under three of the five service attributes. The researchers first noted that customers operating law enforcement sedans ranked the importance of after-hours maintenance support significantly higher than did all other respondents except firefighters. This higher ranking corresponds to the earlier conclusion indicating that the Security Police ranked this same item significantly higher than did all other organizations. This evidence further supports the idea that perhaps Vehicle Maintenance should adjust its service strategy to accommodate Security Police's around-the-clock mission. The fact that the Security Police and firefighters did not significantly differ on the importance of after-hours maintenance is also significant, indicating that emergency response vehicle operators desire 24 hour maintenance support. Again, adjustments in Vehicle

Maintenance service strategies may be required to support these customers' needs.

It is also important to note that materials handling equipment operators (primarily Supply personnel) ranked the performance of "Fixes only customer identified vehicle discrepancies each visit" higher than did all other vehicle type operators except those in the "Other Special Purpose" category. Additionally, these same operators ranked the performance for "Performs reliable maintenance" significantly lower than did all other vehicle type operators (again with the exception of those in the "Other Special Purpose" category). A comparison of the high and low rankings for these two criteria could indicate that while materials handling equipment operators like the Vehicle Maintenance practice of fixing only customer identified vehicle discrepancies each visit (as opposed to fixing additional discrepancies identified by Vehicle Maintenance personnel), they perceive the reliability of the maintenance as poor. The researchers note that while fixing only customer identified vehicle discrepancies is intended to reduce vehicle downtime, poor maintenance reliability generally means more total vehicle downtime. The rankings here might suggest that Vehicle Maintenance managers focus more on the quality of vehicle repairs and less on short-term vehicle downtime.

Differences in the importance and frequency ratings of the customers service attributes first indicated that both

firefighters and law enforcement personnel rated the importance of General Service significantly higher than did most other vehicle operators. These ratings reinforce the above suggestion that the greater importance placed on General Service might be attributed to the around-the-clock missions of emergency response vehicles. The researchers also found that refueling vehicle operators rated the frequency of General Service higher than did all other customers law enforcement and firefighting personnel. This higher rating might be partially attributed to the fact that Vehicle Maintenance is structured to provide dedicated refueling maintenance support. As such, refueling vehicle operators work closely and interface regularly with dedicated refueling vehicle mechanics. One should also note that, like emergency response vehicles, refueling vehicles often operate on a 24 hour basis. The fact that refueling vehicle operators' ratings of General Service did not differ from law enforcement and firefighting personnel may also be significant, possibly reflecting the higher emphasis Vehicle Maintenance places on servicing priority (emergency response) and direct mission support vehicles. However, the earlier low General Service performance rankings from Security Police personnel could indicate that the priority maintenance program does not adequately or equitably meet the needs of those it is designed to support.

In general, the differences by vehicle type for the importance and performance rankings and the frequency

ratings of the customer service elements indicate that Vehicle Maintenance varies in the consistency of service it provides to different customer groups. Although some variation can be expected as vehicle and mission priorities shift, such variation is unacceptable to the customer whose first priority is the service provider's last.

Synopsis. In summary, analysis indicated differences in how customer groups evaluated the importance, performance, and frequency of customer service elements according to prior command, organization, rank, vehicle type, and to a lesser degree, fleet size. Generally, the majority of differences could be directly related to the customers' organizations. For example, vehicle type and fleet size can be directly linked to specific organizations. Even the analysis of data by respondents' ranks indicated a requirement for an organizational focus--a single set of service expectations understood by all members of an organization. In short, the majority of analysis supported an organizationally focused customer service strategy. This requirement for a specific customer focus parallels the findings of commercial and federal service studies, which indicate that without such a focus, it is impossible for service providers to effectively meet customers' expectations.

#### Specific Objective 4

Recommend a set of customer oriented Vehicle Maintenance performance measures based on the findings in objectives 1 through 3.

The conclusions for this specific objective were derived from the research objective stated above. Based on the findings to specific objectives 1 through 3, the researchers came to three general conclusions regarding Vehicle Maintenance performance measures.

First, performance measures must be tailored to the organization. The analysis clearly demonstrated wide diversity among the various organizational customers with respect to the type of service they expected from Vehicle Maintenance. This implies that performance measures developed to focus on individual organizations versus the total fleet will provide better insight into specific customer needs and help managers better evaluate Vehicle Maintenance's ability to meet those needs. Furthermore, no one set of measures will adequately assess Vehicle Maintenance's performance with respect to a specific customer's requirements. With the exception of a few specialized vehicle categories, the current Vehicle Maintenance performance measures primarily focus on wing and/or base statistics (i.e., vehicle in-commission rates, vehicles down for parts and maintenance rates). Although these statistics provide maintenance managers with a tool to evaluate their internal processes, the current measures do

little to evaluate Vehicle Maintenance's performance from a customer's perspective and can in fact mask potential problem areas (i.e., high out-of-commission rates for customers with small vehicle fleets).

Second, performance measures must incorporate some measure of quality. The literature review indicated that customer service measures must have customer satisfaction as their primary focus; therefore, customer inputs must be considered in establishing those measures, which should be a direct reflection of the service criteria the customer deems most important. Because this research indicated that Vehicle Maintenance Quality was the service attribute most important to customers, it follows that any comprehensive Vehicle Maintenance performance measurement system must incorporate quality measures.

Evaluating the measurement system currently available to Vehicle Maintenance, the researchers believe the tools to measure maintenance quality are already in place. Specifically, monitoring repeat and repetitive maintenance statistics from the On-Line Vehicle Integrated Management System (OLVIMS) could provide Vehicle Maintenance managers with the information necessary to help measure performance and ultimately provide better quality service to their customers. For the purpose of this research, repeat maintenance is defined as the return of a vehicle for the same repair within a specified period. Monitoring repeat maintenance can help managers determine the quality of

repairs performed. More specifically, monitoring repeat maintenance can help managers pinpoint internal problems while giving them a barometric reading of the service level they are providing to their customers.

Repetitive maintenance, defined here as returning a vehicle to Vehicle Maintenance multiple times for different repairs in a specific period, is another way to evaluate the quality of service provided to customers. Monitoring repetitive maintenance will provide managers with an overall picture of the quality of their diagnostic and quality control inspection processes. Here again, managers can identify internal problems and get a reading of the service provided to their customers.

High numbers in repeat and repetitive maintenance would indicate that customers are not receiving quality maintenance. Since Vehicle Maintenance Quality was identified as the most important attribute to customers overall, Vehicle Maintenance managers should incorporate the joint use of repeat and repetitive maintenance measures to evaluate their performance. As discussed earlier, these measures should be used to evaluate Vehicle Maintenance's performance for specific organizations, not for the total fleet. By evaluating performance with respect to specific customers verses the total fleet, Vehicle Maintenance managers could tailor service strategies to meet specific organizations' needs, ultimately improving their overall performance and service quality.

Lastly, performance measures must incorporate some measure of timeliness. The most appropriate measurement systems directly reflect customer requirements. This research indicated that timeliness was the second most important service attribute to Vehicle Maintenance customers, so it follows that timeliness measures should be incorporated into any comprehensive Vehicle Maintenance performance measurement system. Currently ACC is monitoring the percentages of vehicle repairs completed within specific time frames (i.e., within 24 hours, between 24 and 48 hours, more than 72 hours, etc.). These measures give Vehicle Maintenance managers a good general idea of how timely their service is, but, as the literature review demonstrated, timeliness measures must be used in conjunction with quality measures. As Emmelhainz notes, it is intuitive that an organization could improve performance on one measure by ignoring the other. That is, maintenance service time could be reduced at the expense of maintenance quality (20:35). In Vehicle Maintenance, the use of timeliness measures alone could mask maintenance quality problems, specifically repeat and repetitive maintenance problems. Additionally, because timeliness measures generally focus on relatively short time horizons (i.e. vehicle turn-around time), they fail to reflect the long-term total down-time a vehicle can accrue due to return visits to Vehicle Maintenance. Similarly, quality measures fail to provide Vehicle Maintenance managers a means for evaluating their

performance in meeting customers' time requirements. By monitoring both quality and timeliness measures simultaneously, managers can identify trends in both areas. Ideally, the goal for Vehicle Maintenance is more timely service and a higher level of quality. Only by measuring both of these areas will managers get a comprehensive picture of the service level provided to their customers. Again, for reasons discussed above, timeliness and quality measures should both be used with an organizational focus.

To summarize, Vehicle Maintenance performance measures must include both quality and timeliness measures and must focus on specific customer organizations. The researchers believe that OLVIMS provides these tools to Vehicle Maintenance managers--it is merely a matter of focusing on the appropriate information. By combining the information available through repeat and repetitive maintenance reports and using the current system of monitoring service times, Vehicle Maintenance managers can determine if their level of support is improving or declining. It is important to note that these tools will provide a relative evaluation of service and not a specific number that can be evaluated as "good" or "bad". Rather, these measures will enable the manager to determine whether service has improved or declined relative to that of previous periods.

### General Recommendations

In addition to the conclusions for the specific objectives addressed above, the researchers make three general recommendations based on the results of the data analysis in Chapter IV. Those recommendations are discussed below.

Commanders must educate their personnel on the organization's service needs/expectations. As previously discussed, analysis showed that there is general disagreement between personnel of different ranks on what is important with regard to Vehicle Maintenance service. This implies that within a given organization there will be general disagreement about what is wanted/expected from Vehicle Maintenance. If expectations within an organization are inconsistent, such disagreement could make it almost impossible for Vehicle Maintenance managers to provide service based on their customers' expectations. To resolve this problem, organization commanders must take an active role in determining what expectations they have of Vehicle Maintenance. Once that determination is made, the requirements must be communicated to other squadron personnel. Only when an organization has a consistent set of expectations can Vehicle Maintenance attempt to satisfy it.

Develop strategic alliances. As pointed out in Chapter II, the move toward quality within industry has seen the development of strategic alliances between suppliers and

customers. The researchers believe there is benefit to be gained by the formation of strategic alliances between Vehicle Maintenance and their customers. This goes beyond the present service boundaries and involves evaluating Vehicle Maintenance processes to determine which areas can be improved to directly support customers' requirements. For example, one topic that repeatedly surfaced during data analysis was the need for twenty-four hour service for emergency response vehicles. Currently, most Vehicle Maintenance organizations operate five days a week, eight hours a day, with a stand-by mechanic on call after duty hours. Respondents from Civil Engineering (firetrucks) and Security Police highlighted a need for after-hours service beyond the current "on call" program. The researchers suspect these needs might be similar for all emergency response organizations (i.e. hospital) even though these groups were not included in the study.

Meeting requirements for twenty-four hour maintenance support is just one example of how the development of strategic alliances can enhance Vehicle Maintenance's customer service level. The development of strategic alliances presents a number of potential benefits to both Vehicle Maintenance and its customers. For customers, those benefits could include more timely, flexible, and responsive service as well as increased maintenance quality and higher vehicle in-commission rates. Benefits to Vehicle Maintenance might also include higher vehicle in-commission

rates, as well as improved customer relations, and a more efficient and effective allocation of resources.

Continued research. The researchers recommend that further research be conducted concerning Vehicle Maintenance customer service. This research identified the structural issues that are important for ACC to provide quality customer service in Vehicle Maintenance, but because of time limitations, it was not possible to examine all the possible independent or dependent variables involved, nor was it possible to test for correlations or interactions between variables. Therefore, further research is necessary to help refine those importance, performance, and frequency factors that will support Vehicle Maintenance service quality measures and help direct Vehicle Maintenance managers on a path of continuous improvement.

Of the five service dimensions studied (General Service, Information Availability, Professionalism of Vehicle Maintenance Personnel, Vehicle Maintenance Timeliness, and Vehicle Maintenance Quality), quality and timeliness were identified as most important, and there exists a need to have a known and shared expectation among a customer group's employees, particularly with respect to these two factors. This study also identified twenty-nine criteria that were useful in varying degrees for evaluating Vehicle Maintenance performance. What this research has not done is identify what values are most appropriate for those twenty-nine criteria. The researchers therefore suggest

further data collection and analysis on the twenty-nine criteria to determine whether they serve to motivate improved performance by Vehicle Maintenance organizations.

• It is also suggested that the Air Force test the conclusions presented here in other MAJCOMS to determine if they are applicable in other Air Force Vehicle Maintenance organizations. Additionally, the Air Force should consider these ideas as an approach to measuring Aircraft Maintenance customer satisfaction. Finally, the DOD should consider testing this customer satisfaction approach for all its service organizations.

## Appendix A: Customer Satisfaction Survey



DEPARTMENT OF THE AIR FORCE  
HEADQUARTERS AIR COMBAT COMMAND  
LANGLEY AIR FORCE BASE, VIRGINIA

FROM: LGT

3 MAY 93

SUBJ: Customer Satisfaction Survey

TO: Wing Transportation Customer

1. Air Combat Command wing transportation organizations are committed to providing the best possible support and service to their customers. Attached you will find a questionnaire concerning YOUR ideas about the customer service provided by wing transportation vehicle maintenance.
2. The purpose of this research is not to identify whether a particular vehicle maintenance branch is good or bad at pleasing their customers. Rather, the intent is identify what you, the customer, thinks is important in terms of customer service. The results of this survey will be used to identify aspects of vehicle maintenance customer service that can be improved.
3. The questionnaire is divided into three parts. PART A asks you for demographic information, PART B asks you to rate the importance of service factors and to report how often you have observed these factors, PART C asks you to rank the service factors in the order of importance to you.
4. Participation in this survey is completely voluntary and your anonymity is guaranteed. Demographic data will only be used to identify the service requirements of different groups of customers.
5. A pre-addressed envelope is enclosed for your convenience. Please return your response within 5 days.
6. YOUR RESPONSE IS VERY IMPORTANT! Help us identify what vehicle maintenance can do to serve you better. Thank you for your support and cooperation.
7. If you have any questions, please contact Captains Bass or Dahl at DSN 785-7777.

RONALD W. WAGGONER, Colonel, USAF  
Chief, Transportation Division  
Directorate of Logistics

*Global Power For America*

### INSTRUCTIONS

This survey contains 133 items and should take approximately 30 minutes to complete. All items must be answered by filling in the appropriate spaces on the machine-scored answer sheets provided.

Please use a soft-lead (No. 2) pencil, and

1. Make heavy black marks that fill in the space of the answer you select.
2. Completely erase any answers you want to change.
3. Make no stray markings on the answer sheet.
4. Do not staple, fold or tear the answer sheet.
5. Do not put your name on the survey or the answer sheet--responses are anonymous

When you are finished, please mail the answer sheet with the survey in the self-addressed envelope provided. Please return your responses WITHIN 5 WORKING DAYS after receipt of the survey.

**SURVEY OF CUSTOMER SATISFACTION WITH  
BASE VEHICLE MAINTENANCE**

**PART A: BACKGROUND INFORMATION.** This section is designed to collect background information that will be used to evaluate differences between groups of customers. Please read each item carefully and code the answer sheet with the response that most accurately describes your present status.

1. To which organization are you currently assigned?

- 1) Civil Engineering
- 2) Security Police
- 3) Supply
- 4) Transportation
- 5) Aircraft Maintenance
- 6) Other

2. What is your rank?

- 1) Field Grade Officer
- 2) Company Grade Officer
- 3) Senior NCO (CMSgt, SMSgt, MSgt)
- 4) NCO
- 5) Airman

3. What size vehicle fleet are you responsible for?

- 1) 1 - 50
- 2) 51 - 100
- 3) 101 - 150
- 4) 151 or more

4. Choose the ONE type of vehicle you are primarily responsible for. (Note: Where appropriate, later questions should be answered with this type of vehicle in mind)

- |                       |                           |
|-----------------------|---------------------------|
| 1) General Purpose    | 5) Law Enforcement Sedans |
| 2) Refueling          | 6) Flightline Tow         |
| 3) Firefighting       | 7) Other Special Purpose  |
| 4) Materials Handling |                           |

**PART B: CUSTOMER SERVICE FACTORS.** This section is designed to collect information about the importance you place on customer service elements and your opinion of Vehicle Maintenance's performance in those areas.

### INSTRUCTIONS

After each phrase there are two sets of responses:

1. For the first set of numbers, please choose the number that best expresses **HOW IMPORTANT** that element of customer service is to you. The numbers 1-7 correspond to service that is:

Of No Importance	Of Very Minor Importance	Moderately Important	Of Average Importance	Very Important	Of Major Importance	Critically Important
1	2	3	4	5	6	7

2. For the second set of numbers, please choose the number that best describes **HOW OFTEN** Vehicle Maintenance **PERFORMS** that element of customer service. If you can not evaluate Maintenance's performance with respect to a particular element, please answer N/A. The performance scale is:

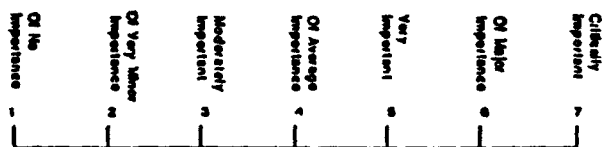
N/A	Never (0%)	Seldom (1 - 20%)	Sometimes (21 - 40%)	About Half (41 - 60%)	Usually (61 - 80%)	Mostly (81 - 99%)	Always (100%)
	1	2	3	4	5	6	7

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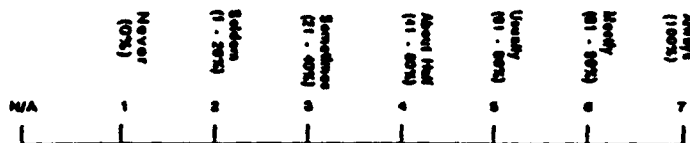
*****
*                                     *
*                               EXAMPLE *
* Promptly answers the telephone      *
*                                     *
*   1. HOW IMPORTANT?                1  2  3  4  5  6  7 *
*                                     *
*   2. HOW OFTEN?                    N/A 1  2  3  4  5  6  7 *
*                                     *
* If this element is of major importance to you, select 6 for *
* "HOW IMPORTANT?". If Vehicle Maintenance seldom answers the *
* telephone promptly, select 2 for "HOW OFTEN?". *
*****

```

HOW IMPORTANT  
IS THIS TO YOU?



HOW OFTEN  
DOES  
VEHICLE  
MAINTENANCE  
DO THIS?



### A. GENERAL SERVICE

Takes appropriate action to resolve problems when they occur

- |                   |     |   |   |   |   |   |   |   |
|-------------------|-----|---|---|---|---|---|---|---|
| 5. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 6. HOW OFTEN?     | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Operates during hours that accommodate my organization's work schedule

- |                   |     |   |   |   |   |   |   |   |
|-------------------|-----|---|---|---|---|---|---|---|
| 7. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 8. HOW OFTEN?     | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Works to accommodate my organization's special requirements

- |                   |     |   |   |   |   |   |   |   |
|-------------------|-----|---|---|---|---|---|---|---|
| 9. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 10. HOW OFTEN?    | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Consistently meets my organization's service needs

- |                    |     |   |   |   |   |   |   |   |
|--------------------|-----|---|---|---|---|---|---|---|
| 11. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 12. HOW OFTEN?     | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Provides after-hour maintenance support (e.g., mobile maintenance)

- |                    |     |   |   |   |   |   |   |   |
|--------------------|-----|---|---|---|---|---|---|---|
| 13. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 14. HOW OFTEN?     | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

Provides training programs to suit my organization's needs (e.g., organizational maintenance, seasonal requirements, etc.)

- |                    |     |   |   |   |   |   |   |   |
|--------------------|-----|---|---|---|---|---|---|---|
| 15. HOW IMPORTANT? |     | 1 | 2 | 3 | 4 | 5 | 6 | 7 |
| 16. HOW OFTEN?     | N/A | 1 | 2 | 3 | 4 | 5 | 6 | 7 |

## GENERAL SERVICE

### RANK ORDER OF IMPORTANCE

Please **RANK ORDER HOW IMPORTANT** the customer service elements in this category are to you. Rank the elements on a scale of 1 to 6 with 1 being the MOST IMPORTANT element, 2 being the second most important element, . . . and 6 being the LEAST IMPORTANT element. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

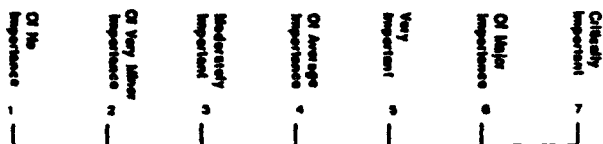
- ☐ 17. Takes appropriate action to resolve problems when they occur
- ☐ 18. Operates during hours that accommodate my organization's work schedule
- ☐ 19. Works to accommodate my organization's special requirements
- ☐ 20. Consistently meets my organization's service needs
- ☐ 21. Provides after-hour maintenance personnel (e.g., mobile maintenance)
- ☐ 22. Provides training programs to suit my organization's needs (e.g., organizational maintenance, seasonal requirements, etc.)

### RANK ORDER OF PERFORMANCE

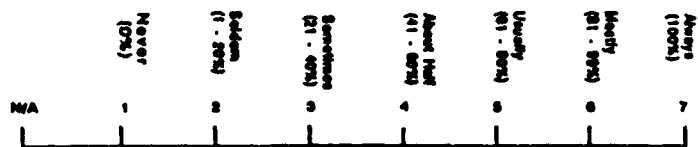
Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** of the customer service elements in this category. Rank the elements on a scale of 1 to 6 with 1 being the element they PERFORM BEST, 2 being the element they perform second best, . . . and 6 being the element they PERFORM LEAST ADEQUATELY. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 23. Takes appropriate action to resolve problems when they occur
- ☐ 24. Operates during hours that accommodate my organization's work schedule
- ☐ 25. Works to accommodate my organization's special requirements
- ☐ 26. Consistently meets my organization's service needs
- ☐ 27. Provides after-hour maintenance personnel (e.g., mobile maintenance)
- ☐ 28. Provides training programs to suit my organization's needs (e.g., organizational maintenance, seasonal requirements, etc.)

HOW IMPORTANT  
IS THIS TO YOU?



HOW OFTEN  
DOES  
VEHICLE  
MAINTENANCE  
DO THIS?



## **B. INFORMATION AVAILABILITY**

### **Provides information on scheduled maintenance**

29. HOW IMPORTANT? 1 2 3 4 5 6 7
30. HOW OFTEN? N/A 1 2 3 4 5 6 7

### **Provides information on projected vehicle repair completion times**

31. HOW IMPORTANT? 1 2 3 4 5 6 7
32. HOW OFTEN? N/A 1 2 3 4 5 6 7

### **Provides information on changes to projected repair completion times**

33. HOW IMPORTANT? 1 2 3 4 5 6 7
34. HOW OFTEN? N/A 1 2 3 4 5 6 7

### **Minimizes the effort to reach maintenance service personnel by telephone**

35. HOW IMPORTANT? 1 2 3 4 5 6 7
36. HOW OFTEN? N/A 1 2 3 4 5 6 7

### **Provides information on maintenance policies (e.g., vehicle turn-in policies, etc.)**

37. HOW IMPORTANT? 1 2 3 4 5 6 7
38. HOW OFTEN? N/A 1 2 3 4 5 6 7

### **Provides information on changes to maintenance policies**

39. HOW IMPORTANT? 1 2 3 4 5 6 7
40. HOW OFTEN? N/A 1 2 3 4 5 6 7

## INFORMATION AVAILABILITY

### RANK ORDER OF IMPORTANCE

Please **RANK ORDER HOW IMPORTANT** the customer service elements in this category are to you. Rank the elements on a scale of 1 to 6 with 1 being the MOST IMPORTANT element, 2 being the second most important element, . . . and 6 being the LEAST IMPORTANT element. USE EACH NUMBER ONLY ONCE. Please indicate your ratings on the answer sheet.

- ☐ 41. Provides information on scheduled maintenance
- ☐ 42. Provides information on projected vehicle repair completion times
- ☐ 43. Provides information on changes to projected repair completion times
- ☐ 44. Minimizes the effort to reach maintenance service personnel by telephone
- ☐ 45. Provides information on maintenance policies (e.g., vehicle turn-in policies, etc.)
- ☐ 46. Provides information on changes to maintenance policies

### RANK ORDER OF PERFORMANCE

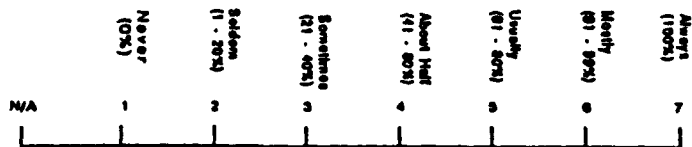
Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** of the customer service elements in this category. Rank the elements on a scale of 1 to 6 with 1 being the element they PERFORM BEST, 2 being the element they perform second best, . . . and 6 being the element they PERFORM LEAST ADEQUATELY. USE EACH NUMBER ONLY ONCE. Please indicate your ratings on the answer sheet.

- ☐ 47. Provides information on scheduled maintenance
- ☐ 48. Provides information on projected vehicle repair completion times
- ☐ 49. Provides information on changes to projected repair completion times
- ☐ 50. Minimizes the effort to reach maintenance service personnel by telephone
- ☐ 51. Provides information on maintenance policies (e.g., vehicle turn-in policies, etc.)
- ☐ 52. Provides information on changes to maintenance policies

HOW IMPORTANT  
IS THIS TO YOU?



HOW OFTEN  
DOES  
VEHICLE  
MAINTENANCE  
DO THIS?



### C. PROFESSIONALISM OF VEHICLE MAINTENANCE PERSONNEL

#### Displays courtesy

53. HOW IMPORTANT?		1	2	3	4	5	6	7
54. HOW OFTEN?	N/A	1	2	3	4	5	6	7

#### Displays military bearing

55. HOW IMPORTANT?		1	2	3	4	5	6	7
56. HOW OFTEN?	N/A	1	2	3	4	5	6	7

#### Meets military appearance standards (e.g., AFR 35-10 standards, weight standards, etc.)

57. HOW IMPORTANT?		1	2	3	4	5	6	7
58. HOW OFTEN?	N/A	1	2	3	4	5	6	7

#### Displays enthusiasm

59. HOW IMPORTANT?		1	2	3	4	5	6	7
60. HOW OFTEN?	N/A	1	2	3	4	5	6	7

#### Displays concern for customers

61. HOW IMPORTANT?		1	2	3	4	5	6	7
62. HOW OFTEN?	N/A	1	2	3	4	5	6	7

#### Displays a willingness to help

63. HOW IMPORTANT?		1	2	3	4	5	6	7
64. HOW OFTEN?	N/A	1	2	3	4	5	6	7

## **PROFESSIONALISM OF VEHICLE MAINTENANCE PERSONNEL**

### **RANK ORDER OF IMPORTANCE**

Please **RANK ORDER HOW IMPORTANT** the customer service elements in this category are to you. Rank the elements on a scale of 1 to 6 with **1** being the **MOST IMPORTANT** element, **2** being the second most important element, . . . and **6** being the **LEAST IMPORTANT** element. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 65. Displays courtesy
- ☐ 66. Displays military bearing
- ☐ 67. Meets military appearance standards (e.g., AFR 35-10 standards, weight standards, etc.)
- ☐ 68. Displays enthusiasm
- ☐ 69. Displays concern for customers
- ☐ 70. Displays a willingness to help

### **RANK ORDER OF PERFORMANCE**

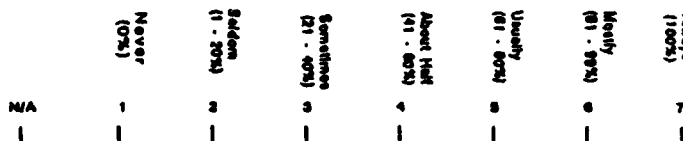
Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** of the customer service elements in this category. Rank the elements on a scale of 1 to 6 with **1** being the element they **PERFORM BEST**, **2** being the element they **perform second best**, . . . and **6** being the element they **PERFORM LEAST ADEQUATELY**. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 71. Displays courtesy
- ☐ 72. Displays military bearing
- ☐ 73. Meets military appearance standards (e.g., AFR 35-10 standards, weight standards, etc.)
- ☐ 74. Displays enthusiasm
- ☐ 75. Displays concern for customers
- ☐ 76. Displays a willingness to help

HOW IMPORTANT  
IS THIS TO YOU?



HOW OFTEN  
DOES  
VEHICLE  
MAINTENANCE  
DO THIS?



#### D. VEHICLE MAINTENANCE TIMELINESS

##### Minimizes vehicle turn-in time

77.	HOW IMPORTANT?		1	2	3	4	5	6	7
78.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Minimizes vehicle pickup time

79.	HOW IMPORTANT?		1	2	3	4	5	6	7
80.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Meets estimated vehicle repair schedule

81.	HOW IMPORTANT?		1	2	3	4	5	6	7
82.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Minimizes vehicle repair time

83.	HOW IMPORTANT?		1	2	3	4	5	6	7
84.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Minimizes total vehicle maintenance processing time (turn-in, repair, and pickup)

85.	HOW IMPORTANT?		1	2	3	4	5	6	7
86.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Minimizes time to answer my questions

87.	HOW IMPORTANT?		1	2	3	4	5	6	7
88.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

## VEHICLE MAINTENANCE TIMELINESS

### RANK ORDER OF IMPORTANCE

Please **RANK ORDER HOW IMPORTANT** the customer service elements in this category are to you. Rank the elements on a scale of 1 to 6 with 1 being the MOST IMPORTANT element, 2 being the second most important element, . . . and 6 being the LEAST IMPORTANT element. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 89. Minimizes vehicle turn-in time
- ☐ 90. Minimizes vehicle pickup time
- ☐ 91. Meets estimated vehicle repair schedule
- ☐ 92. Minimizes vehicle repair time
- ☐ 93. Minimizes total vehicle maintenance processing time (turn-in, repair, and pickup)
- ☐ 94. Minimizes time to answer my questions

### RANK ORDER OF PERFORMANCE

Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** of the customer service elements in this category. Rank the elements on a scale of 1 to 6 with 1 being the element they PERFORM BEST, 2 being the element they perform second best, . . . and 6 being the element they PERFORM LEAST ADEQUATELY. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 95. Minimizes vehicle turn-in time
- ☐ 96. Minimizes vehicle pickup time
- ☐ 97. Meets estimated vehicle repair schedule
- ☐ 98. Minimizes vehicle repair time
- ☐ 99. Minimizes total vehicle maintenance processing time (turn-in, repair, and pickup)
- ☐ 100. Minimizes time to answer my questions

HOW IMPORTANT  
IS THIS TO YOU?

1	2	3	4	5	6	7
Of No Importance	Of Very Minor Importance	Moderately Important	Of Average Importance	Very Important	Of Major Importance	Critically Important

HOW OFTEN  
DOES  
VEHICLE  
MAINTENANCE  
DO THIS?

N/A	1	2	3	4	5	6	7
	Never (0%)	Seldom (1 - 20%)	Sometimes (21 - 40%)	About Half (41 - 60%)	Usually (61 - 80%)	Mostly (81 - 90%)	Always (100%)

#### E. VEHICLE MAINTENANCE QUALITY

##### Provides quality vehicle repairs

101.	HOW IMPORTANT?		1	2	3	4	5	6	7
102.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Fixes only customer identified vehicle discrepancies each visit

103.	HOW IMPORTANT?		1	2	3	4	5	6	7
104.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Fixes all vehicle discrepancies each visit (both customer and Vehicle Maintenance identified)

105.	HOW IMPORTANT?		1	2	3	4	5	6	7
106.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Fixes vehicle discrepancies the first time

107.	HOW IMPORTANT?		1	2	3	4	5	6	7
108.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

##### Performs reliable maintenance

109.	HOW IMPORTANT?		1	2	3	4	5	6	7
110.	HOW OFTEN?	N/A	1	2	3	4	5	6	7

## VEHICLE MAINTENANCE QUALITY

### RANK ORDER OF IMPORTANCE

Please **RANK ORDER HOW IMPORTANT** the customer service elements in this category are to you. Rank the elements on a scale of 1 to 5 with 1 being the MOST IMPORTANT element, 2 being the second most important element, . . . and 5 being the LEAST IMPORTANT element. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 111. Provides quality vehicle repairs
- ☐ 112. Fixes only customer identified vehicle discrepancies each visit
- ☐ 113. Fixes all vehicle discrepancies each visit (both customer and Vehicle Maintenance identified)
- ☐ 114. Fixes vehicle discrepancies the first time
- ☐ 115. Performs reliable maintenance

### RANK ORDER OF PERFORMANCE

Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** of the customer service elements in this category. Rank the elements on a scale of 1 to 5 with 1 being the element they PERFORM BEST, 2 being the element they perform second best, . . . and 5 being the element they PERFORM LEAST ADEQUATELY. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 116. Provides quality vehicle repairs
- ☐ 117. Fixes only customer identified vehicle discrepancies each visit
- ☐ 118. Fixes all vehicle discrepancies each visit (both customer and Vehicle Maintenance identified)
- ☐ 119. Fixes vehicle discrepancies the first time
- ☐ 120. Performs reliable maintenance

**Part C: RANKING OF CUSTOMER SERVICE CATEGORIES**

**RANK ORDER OF IMPORTANCE**

Please **RANK ORDER HOW IMPORTANT** the customer service categories in this survey are to you. Rank the categories on a scale of 1 to 5 with 1 being the MOST IMPORTANT category, 2 being the second most important category, . . . and 5 being the LEAST IMPORTANT category. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 121. General Service
- ☐ 122. Information Availability
- ☐ 123. Professionalism of Vehicle Maintenance Personnel
- ☐ 124. Vehicle Maintenance Timeliness
- ☐ 125. Vehicle Maintenance Quality

**RANK ORDER OF PERFORMANCE**

Please **RANK ORDER** Vehicle Maintenance's **PERFORMANCE** in the customer service categories in this survey. Rank the categories on a scale of 1 to 5 with 1 being the category they PERFORM BEST, 2 being the category they perform second best, . . . and 5 being the category they PERFORM LEAST ADEQUATELY. **USE EACH NUMBER ONLY ONCE.** Please indicate your ratings on the answer sheet.

- ☐ 126. General Service
- ☐ 127. Information Availability
- ☐ 128. Professionalism of Vehicle Maintenance Personnel
- ☐ 129. Vehicle Maintenance Timeliness
- ☐ 130. Vehicle Maintenance Quality

**ADDITIONAL COMMENTS**

131. a) What aspects of the customer service provided by Vehicle Maintenance do you particularly like?

b) What do you particularly dislike?

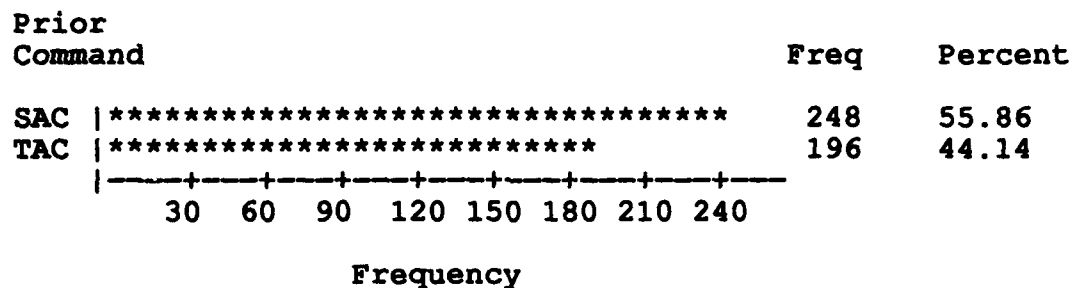
132. Please comment on any customer service elements important to you that were not covered in the survey.

133. Please comment on Vehicle Maintenance's performance with respect to the customer service elements identified in question 132 above.

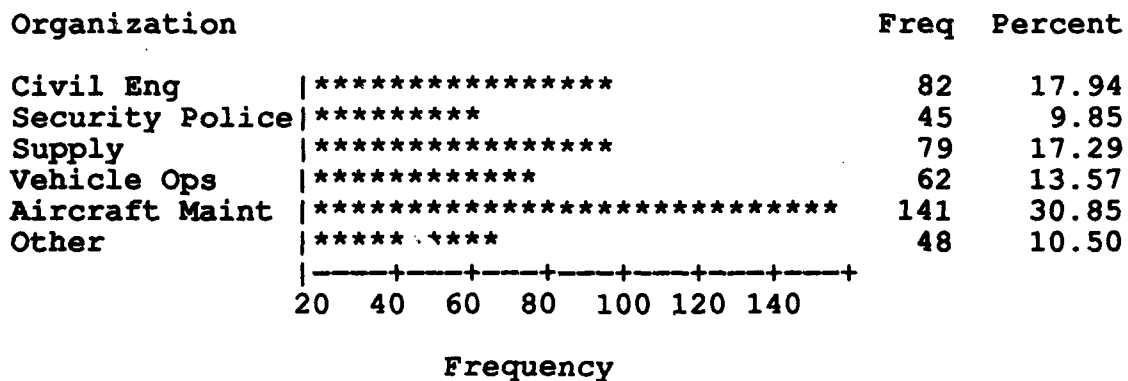
**Thanks for your time and inputs!!**

## Appendix B: Frequency Distributions of Respondent Groups

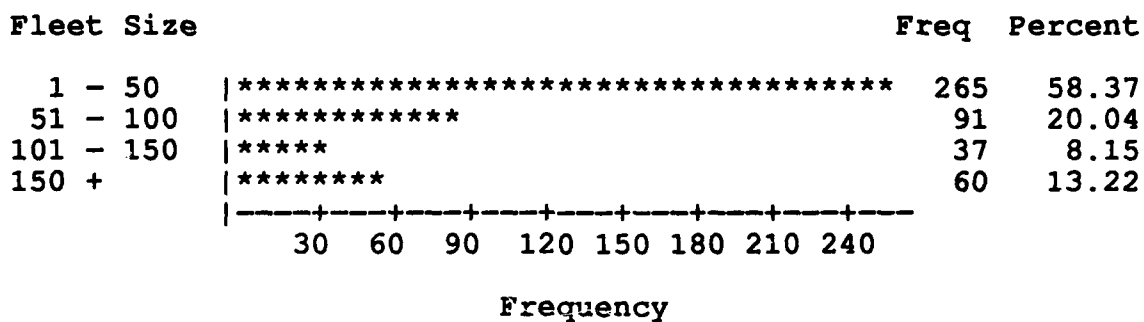
### Respondent Distribution by Prior MAJCOM



### Respondent Distribution by Organization



### Respondent Distribution by Fleet Size



### Respondent Distribution by Rank

Rank		Freq	Percent
Field Grade	*****	65	14.87
Company Grade	*****	53	12.13
Senior NCO	*****	120	27.46
NCO	*****	170	38.90
Airmen	*****	26	5.95

Frequency

### Respondent Distribution by Vehicle Type

Vehicle Type		Freq	Percent
1	*****	278	61.92
2	****	30	6.68
3	***	21	4.68
4	***	22	4.90
5	***	22	4.90
6	****	29	6.46
7	*****	47	10.47

Frequency

- |                        |  |
|------------------------|--|
| 1 - General Purpose    | 5 - Law Enforcement Sedan                  |
| 2 - Refueling          | 6 - Flightline Tow                         |
| 3 - Firefighting       | 7 - Other Special Purpose                  |
| 4 - Materials Handling | (Primarily includes CES special equipment) |

**Appendix C: Importance and Performance Rankings for  
Customer Service Criteria**

**IMPORTANCE AND PERFORMANCE RANKINGS FOR  
GENERAL SERVICE CRITERIA**

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>
Takes appropriate action to resolve problems when they occur	1	1
Consistently meets my organization's service needs	2	4
Works to accommodate my organization's special requirements	3	3
Operates during hours that accommodate my organization's work schedule	4	2
Provides after-hour maintenance personnel	5	5
Provides training programs to suit my organization's needs	6	6
1 = Most important or best performed		

**IMPORTANCE AND PERFORMANCE RANKINGS FOR  
INFORMATION AVAILABILITY CRITERIA**

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>
Provides information on projected vehicle repair completion times	1	2
Provides information on scheduled maintenance	2	1
Provides information on changes to projected repair completion times	3	5
Provides information on maintenance policies	4	3
Minimizes the effort to reach maintenance service personnel by telephone	5	4
Provides information on changes to maintenance policies	6	6
1 = Most important or best performed		

IMPORTANCE AND PERFORMANCE RANKINGS FOR  
PROFESSIONALISM OF VEHICLE MAINTENANCE PERSONNEL  
CRITERIA

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Preformance</u>
Displays a willingness to help	1	3
Displays concern for customers	2	4
Displays courtesy	3	1
Displays enthusiasm	4	6
Displays military bearing	5	2
Meets military appearance standards	6	5

1 = Most important or best performed

IMPORTANCE AND PERFORMANCE RANKINGS FOR  
VEHICLE MAINTENANCE TIMELINESS CRITERIA

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Preformance</u>
Minimizes vehicle repair time	1	5
Minimizes total vehicle maintenance processing time	2	4
Meets estimated vehicle repair schedule	3	6
Minimizes vehicle turn-in time	4	1
Minimizes vehicle pickup time	5	2
Minimizes time to answer my questions	6	3

1 = Most important or best performed

IMPORTANCE AND PERFORMANCE RANKINGS FOR  
VEHICLE MAINTENANCE QUALITY CRITERIA

<u>Item</u>	<u>Order of Importance</u>	<u>Order of Performance</u>
Provides quality vehicle repairs	1	1
Fixes vehicle discrepancies the first time	2	4
Performs reliable maintenance	3	2
Fixes all vehicle discrepancies each visit	4	5
Fixes only customer identified vehicle discrepancies each visit	5	3
1 = Most important or best performed		

### Bibliography

1. Allen, Mary K., Robert L. Cook, M. Bixby Cooper, Omar Keith Helferich, and George D. Waggenheim. "Enhancing The Customer Service Edge with Knowledge Base Transfer," Annual Conference Proceedings. 73-84. Oak Brook IL: Council of Logistics Management, 1991.
2. Bacas, Harry. "Make It Right For The Customer," Nation's Business, 75: 49-51 (November 1987).
3. Becker, Wendy S. and Richard S. Wellins. "Customer-Service Perceptions and Reality," Training & Development Journal, 44: 49-51 (March 1990).
4. Berlenbach, Daniel S. Vehicle Maintenance Chief, Vehicle and Equipment Division, Air Combat Command, Langley AFB VA. Personal Interview. 22 March 1993.
5. Blanding, Warren. "10 Reasons Why You Have A Customer Service Quality Problem (and what you can do about it)," Annual Conference Proceedings of The Council of Logistics Management, October 7-10, 1990. Oak Brook IL: The Council of Logistics Management, 1990.
6. Bowersox, Donald J. and others. Leading Edge Logistics Competitive Positioning for the 1990's. Oak Brook IL: The Council of Logistics Management, 1991.
7. Brisco, Worthey, Lt Col. Chief, Vehicle and Equipment Division, Air Combat Command, Langley AFB VA. Personal Interview. 22 March 1993.
8. Brown, Stephen W. and Teresa A. Swatz. "A Gap Analysis of Professional Service Quality," Journal of Marketing, 53: 92-98 (April 1989).
9. Bryne, Patrick M. and William J. Markham. Improving Quality and Productivity in the Logistics Process-Achieving Customer Satisfaction Breakthroughs. Oak Brook IL: Council of Logistics Management, 1991.
10. Carlucci, Frank C., Secretary of Defense. "Department of Defense Posture on Quality." Letter. Washington DC, 30 August 1988.
11. Connellan, Thomas K. "The Power of Expectations," Annual Conference Proceedings of the Council of Logistics Management, September 29-October 2, 1991. 1-25. Oak Brook IL: The Council of Logistics Management, 1991.

12. Davidrow, William H. and Bro Uttal. Total Customer Service: The Ultimate Weapon. New York: Harper-Perennial, 1990.
13. Department of the Air Force. Secretary of the Air Force Quality Award (Draft). Washington DC: GPO, 1993.
14. Department of the Air Force. Vehicle Maintenance Management. AFM 77-310, Vol II. Washington DC: HQ USAF, 24 April 1987.
15. Department of Commerce. 1993 Award Criteria: Malcom Baldrige National Quality Award. Gaithersburg MD: National Institute of Standards and Technology, 1993.
16. Department of Defense. Total Quality Management Guide. DOD Directive 5000.51-G, Washington DC: GPO, 15 February 1990.
17. Department of Defense. Total Quality Management in the Department of Defense. Pamphlet PB91-154781. Washington DC: GPO, 1988.
18. Desaptnick, Robert L. Managing to Keep the Customer. San Francisco: Jossey-Bass, Inc., 1987.
19. Dilorio, Frank C. SAS Applications Programming: A Gentle Introduction. Boston: PWS-Kent Publishing Company, 1991.
20. Emmelhainz, Larry W. "TQM Principles and Measures: Key to Successful Implementation," Air Force Journal of Logistics, 15: 34-37 (Summer 1991).
21. Emory, William C. and Donald R. Cooper. Business Research Methods (Fourth Edition). Homewood IL: Richard D. Irwin, Inc., 1991.
22. Flores, Esperanza. Customer Service Analysis of Tactical Air Command Base Level Supply Support. MS thesis, AFIT/GLM/LSM/90S-17. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1990 (AD-A229253).
23. Garvin, David A. "How the Baldrige Award Really Works," Harvard Business Review, 69: 80-95 (November-December 1991).
24. Gilmour, Peter. "Development of a Demand Response Function," Journal of Business Logistics, 1: 83-103 (1979).

25. Headquarters United States Air Force/ACM. A Guide for the Development of Attitude and Opinion Survey. HQ USAF/ACM, Pentagon, Washington DC, October 1974.
26. Keane, Kathleen A. "This is Quality," Airman Magazine, 8: 4-13 (August 1992).
27. LaLonde, Bernard J. and Paul H. Zinszer. Customer Service: Meaning and Measurement. Chicago: National Council of Logistics Management, 1991.
28. ----- and Martha C. Cooper. Partnerships in Providing Customer Service: A Third Party Perspective. Oak Brook IL: The Council of Logistics Management, 1989.
29. -----, Martha C. Cooper, and Thomas B. Noordewier. Customer Service: A Management Perspective. Oak Brook IL: The Council of Logistics Management, 1988.
30. ----- and Paul H. Zinszer. Customer Service: Meaning and Measurement. Chicago: National Council of Physical Distribution Management, 1976.
31. Lambert, Douglas M., Howard Marmorstein and Arun Sharma. "The Accuracy of Salespersons' Perceptions of Their Customers: Conceptual Examination and an Empirical Study," Journal of Personal Selling & Sales Management, 10: 1 (Winter 1990).
32. Lambert, Douglas M. and Thomas C. Harrington. "Establishing Customer Service Strategies Within the Market Mix: More Empirical Evidence," Journal of Business Logistics, 10:44-60 (1989).
33. Leedy, Paul D. Practical Research: Planning and Design (Fourth Edition). New York: Macmillan Publishing Company, 1989.
34. Lunde, Brian S. and Sheree L. Marr Walker. "Customer Satisfaction Measurement: Does It Pay Off?" Annual Conference Proceedings of The Council of Logistics Management, October 7-10, 1990. Oak Brook IL: The Council of Logistics Management, 1990.
35. McClave, James T. and P. George Benson. Statistics for Business Economics (Fifth Edition). San Francisco: Dellen Publishing Company, 1991.

36. Meyer, Jack A. and Timothy A. Widowfield. An Evaluation Of Measurements Used To Drive Competitiveness In A Depot Maintenance Environment. MS thesis, AFIT/GLM/LSC/92S-33. School of Systems and Logistics, Air Force Institute of Technology (AU), Wright-Patterson AFB OH, September 1992 (AD-A259676).
37. Office of Management and Budget. How to Develop Quality Measures That Are Useful in Day-to-Day Measurement. Pamphlet PB91-15, 1989.
38. Office of Management and Budget. Quality Measurements Used in Federal Government Programs. Pamphlet PB91-154831. Washington: U.S. Department of Commerce: 1989.
39. Parasuraman A., Valarie Zeithaml, and Leonard L. Berry. "Five Imperatives for Improving Service Quality," Sloan Management Review, 31: 29-38 (Summer 1990).
40. ----- . A Conceptual Model of Service Quality and Its Implications for Future Research. Report No. 84-106. Cambridge: The Marketing Science Institute, 1984.
41. President's Council on Management Improvement. Federal Total Quality Management Handbook. Falls Church VA: DOD-Defense Productivity Program Office, May 1991.
42. Rhea, Marti J. and David L. Shrock. "Measuring the Effectiveness of Physical Distribution Customer Service Programs," Journal of Business Logistics, 8: 31-45 (1987).
43. Saylor, James H. "What Total Quality Management Means to the Logistician," Logistics Spectrum, 24: 19-23 (Mar/Apr 1987).
44. Schlotzhauer, Sandra D. and Ramon C. Littell. SAS System for Elementary Statistical Analysis. Cary NC: SAS Institute Inc., 1991.
45. Smith, Peter A. and others. Logistics in Service Industries. Oak Brook IL: The Council of Logistics Management, 1991.
46. Sterling, Jay U. and Douglas M. Lambert. "Establishing Customer Service Strategies Within The Market Mix," Journal of Business Logistics, 8: 1-30 (1987).

47. Stock, James R. and Douglas M. Lambert. Strategic Logistics Management (Second Edition). Homewood IL: Richard D. Irwin, Inc., 1987.
48. Waggoner, Col Ronald W. Director, Transportation Directorate, Air Combat Command, Langley AFB VA. Personal Interview. 22 March 1993.
49. Willingham, Ron. Hey I'm The Customer. Englewood Cliffs NJ: Prentice Hall, 1992.

### VITA

Captain Lori M. Bass is a 1987 graduate of the Air Force Academy, where she majored in International Affairs/National Security. After completing the Basic Officer Transportation course at Sheppard AFB, TX, Capt Bass was assigned to the 27 Transportation Squadron at Cannon AFB, NM, where she held the positions of Vehicle Operations Officer and Officer in Charge, Combat Plans. In 1990 she was transferred to Beale AFB, CA, where she served as Officer in Charge, Combat Plans, Vehicle Maintenance Officer, and Commander of the 814th Transportation Squadron. In May 1992, Capt Bass entered the School of Logistics and Acquisitions Management at the Air Force Institute of Technology. Upon graduation, she will be assigned to the 616th Airlift Support Squadron at Elmendorf AFB, AK.

Capt Bass is married to Capt Marc P. Bass, also a 1993 AFIT graduate from the Civilian Institution Program at Purdue University.

Permanent address: 8701-209 Belleville Rd  
Belleville, MI 48111

### VITA

Captain Linda J. Dahl entered the Air Force in 1980 and was commissioned through Officer Training School in 1984. After completing the Basic Officer Transportation course, she was assigned to the 375th Transportation Squadron at Scott AFB in Belleville IL. Here she held positions as the base Vehicle Operations Officer and Vehicle Maintenance Officer. In 1986 she was transferred to the 611 Aerial Port Squadron in Osan, South Korea and performed duties as the Passenger Terminal Officer-In-Charge (OIC). In December 1987, Capt Dahl was assigned to the 836th Transportation Squadron at Davis-Monthan AFB in Tucson AZ. While at Davis-Monthan, she held the positions of Vehicle Maintenance Officer, the Vehicle Maintenance/Operations Officer, Combat Plans OIC, and finally, Squadron Commander. During Desert Shield/Desert Storm, Capt Dahl was selected for the position of Chief, Transportation Plans and Programs on the United States Central Command Air Forces Staff in Riyadh Saudi Arabia. Capt Dahl was selected as the Air Force Transportation Company Grade Officer of the Year for 1991. In May 1992, Capt Dahl entered the School of Logistics and Acquisition Management, Air Force Institute of Technology. She will be assigned to the Transportation staff at Air Combat Command, Langley AFB, VA upon graduation.

Permanent address: 309 Water St

Warren PA 16365

REPORT DOCUMENTATION PAGE			Form Approved OMB No. 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302, and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)	2. REPORT DATE September 1993	3. REPORT TYPE AND DATES COVERED Master's thesis		
4. TITLE AND SUBTITLE CUSTOMER SERVICE ANALYSIS OF AIR COMBAT COMMAND VEHICLE MAINTENANCE SUPPORT			5. FUNDING NUMBERS	
6. AUTHOR(S) Lori M. Bass, Captain, USAF Linda J. Dahl, Captain, USAF				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)  Air Force Institute of Technology, WPAFB OH 45433-6583			8. PERFORMING ORGANIZATION REPORT NUMBER  AFIT/GLM/LAC/93S-5	
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)  HQ ACC/LGT Langley AFB VA 23665			10. SPONSORING/MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION/AVAILABILITY STATEMENT  Approved for public release; distribution unlimited			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) The purpose of this study was to recommend a more comprehensive set of Vehicle Maintenance performance measures. A survey was used to collect information from Vehicle Maintenance customers from various organizations throughout ACC. The research had four objectives: 1) identify the customer service elements important to Vehicle maintenance customers; 2) identify customer perceptions about how Vehicle Maintenance meets those elements; 3) compare the perceptions of different customer groups; and 4) recommend customer oriented Vehicle Maintenance performance measures. Data analysis revealed that quality and timeliness were the service factors most important to Vehicle Maintenance customers. Analysis also indicated distinct differences between what customers want, and what they actually receive. Furthermore, the study revealed apparent differences in the service needs of various customer organizations. The researchers concluded that the most comprehensive Vehicle Maintenance performance measurement system should incorporate both quality and timeliness measures and should take an organizational, rather than a base-wide focus. Recommendations were offered to Vehicle Maintenance managers and suggestions for future research were given.				
14. SUBJECT TERMS  Transportation, Vehicles, Quality, Management			15. NUMBER OF PAGES	
			16. PRICE CODE 169	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT U1	

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d. Of No  
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